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Why Our Brains Believe

BRAIN SCIENCE, GOD SCIENCE
By Michael McGuire and Lionel Tiger

HOW RELIGION RESISTS SCIENCE

Special Report: Did a Cosmic Impact Kill the Mammoths?

Genetic Algorithm Bests Intelligent Design

Hormone Replacement Therapy: A New Look

Power Balance: Pseudoscientific Silliness

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From the Editor

Why Our Brains Believe

Do our brains invent gods? Science has good insights about that, and we explore the evidence in our cover report "Why Our Brains Believe." The lead article, "Brain Science, God Science," is by two distinguished scholars, neuroscientist Michael McGuire and anthropologist Lionel Tiger, authors of the new book *God's Brain*. Drawing on social science and neurobiology, they show how our brains devise strategies for countering stress, uncertainty, and fear, which leads to social stratagems and the secretion of brain chemicals that increase predictability and combat stress. Religious belief is an almost inevitable result. In the second article, University of Helsinki academy fellow Ilkka Pyysiäinen comes at the question from a slightly different perspective but with a very similar conclusion.

The Winter of Our Discontent

This has been quite a winter of discontent for climatologists and climate science. Seldom has an entire scientific field been subject to such a concentrated barrage of bad news and external attacks. The hacked e-mail controversy was followed by repeated rounds of revelations of alleged data mishandling and several embarrassing mistakes in public reports. Whether spring brings a thaw remains to be seen. Scientific leaders, correctly, called on efforts to ensure integrity in science. They feared the situation would not only diminish public trust of climate science but spill over into other areas of science as well. Climatologists reeled under the attacks, shell-shocked by waves of assaults common in political battles but fairly alien to scientific circles. Most scientists aren't particularly good communicators in turbulent public arenas. They're trained to do science, publish in journals, and let the facts fall where they may. They are less equipped at defending themselves against extrascientific arguments.

One troubling aspect of this essentially bogus controversy has been a lack of proportion. Most knowledgeable scientists, and virtually all climatologists, felt the attacks and criticisms were out of proportion to the mistakes made. Those who most strongly dispute climate science seemed to think they had succeeded in demolishing the entire enterprise, doing away with three decades of climate science observations and results. That is clearly not the case. Most scientists felt that little if anything about the actual scientific evidence had changed—except for public perceptions, which had worsened dramatically. Disputers were winning the public relations war by default.

Another concern is the tone of blatant hostility toward science and scientists. I fear a vast cultural war is under way. This is no regular scientific 'controversy.' Noted climate experts have received death threats. Open-minded, evidence-based scientific discourse carried out in scientific arenas has been supplanted by nasty "gotcha" antiscience propaganda conducted in blogs, talk radio, op-eds, and the glare of the media. Science isn't done that way. But it *is* how public opinion—for better or worse—is molded.

Perhaps the most troubling aspect is this: the tactics employed by the strongest critics of climate science are hauntingly similar to those used by creationists in their attempts to undermine evolution. This is no accident. The evidence is now clear that the recent assaults have been actively encouraged by a well-funded, highly organized political campaign to denigrate climate science and portray it as no better than opinion. We are even seeing a round of efforts this year in state legislatures to pass resolutions to "teach the controversy" about climate change. Sound familiar?

As March blew in, there were signs climate scientists were fighting back. The IPCC called for an outside review of its work. The National Academy of Sciences was preparing a nontechnical paper for the public. The National Oceanic and Atmospheric Administration launched a new Climate Services office and excellent climate Web site (www.climate.gov) for easy public access to displays of the latest data.

Four noted U.S. scientists drafted a 2,830-word Open Letter "to bring the focus back to credible science, rather than invented hyperbole." It noted that while the pattern of increasing temperatures over the past 150 years has not been smooth or monotonic, "14 of the 15 warmest years in the instrumental record have been experienced between 1995 and 2009." They acknowledged several problems in the IPCC report but added, "Claims of widespread and deliberate manipulation of scientific data and fundamental conclusions in the Fourth Assessment report are not supported by the facts." Nevertheless, they called for extra attention in the writing of the next round of assessments, and they provided detailed suggestions. Hundreds of climate scientists signed the letter, which was given to federal agencies March 13.

On March 5, the British Meteorological Office released a major review of more than one hundred scientific studies that track changes in climate. Conclusion: "Our planet is changing rapidly and man-made greenhouse gas emissions are very likely to be the cause."

While words flew and humans squabbled, the planet went on its merry warmer way. In late January, a NASA Goddard Institute of Space Studies analysis of new temperature data gathered worldwide gave this global picture: 2009 was tied as the second warmest year recorded in the 130 years of global instrumental temperature records. (This despite the brutal winter in the eastern U.S., which kept average global temperatures from rising even further and skewed public perceptions.) Globally, 2009 was virtually as warm as the other warmest years of 1998, 2002, 2003, 2006, and 2007, and only a fraction of a percent cooler than the warmest year, 2005. The entire Southern Hemisphere was the warmest it has ever been since measurements have been made. And the Arctic was far warmer than usual. Globally, each of the past four decades has now been warmer than the decade preceding it.

The heated rhetoric may or may not cool, but the planet, as does nature generally, works according to its own logic.

—Kendrick Frazier

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Pseudoscience and the Iraq War: Bogus 'Bomb Detectors' Cost Money and Lives

JAY M. PASACHOFF

There are so many things to be upset about with the situation in Iraq, but the pseudoscience in play is particularly painful. For a recent interview on pseudoscience, dealing with my selection as a fellow of the Committee for Skeptical Inquiry, I was asked for an example of a downside of pseudoscience and, with the Iraq example below in mind, I said, "It costs lives." It wastes money, too.

Here's what I was referring to.

The New York Times reported on January 23 that the director of a British company that supplies bomb detectors to Iraq was arrested on fraud charges. The British company TSC Ltd. sold at least eight hundred of these "bomb detectors" called ADE 651 to the Iraqi government and was paid at least $85 million for them.

The *Times*'s article, by Riyadh Mohammed from Baghdad and Rod Norland from Kabul, said, "The ADE 651 is a hand-held wand with no batteries or internal electronic components, ostensibly powered by the static electricity of the user, who needs to walk in place to charge it. The only moving part is what looks like a radio antenna on a swivel, which swings to point toward the presence of weapons or explosives." It is a current-day dowsing rod.

Norland had already reported, in a November 3 *New York Times* article, that this useless device was in use at "hundreds of checkpoints in Iraq" and that the devices "are now normally used in place of physical inspections of vehicles."

That article reported that the James Randi Educational Foundation had offered a million dollars if the device could detect explosives but that the offer hadn't been taken up. Still, the head of the Iraqi Ministry of the Interior's General Directorate for Combating Explosives, Major General Jehad al-Jabiri, believes in it.

In one of the recent articles, a government official from the Iraqi Parliament's Security and Defense Committee is quoted as saying, "This company not only caused grave and massive losses of funds, but it has caused grave and massive losses of the lives of innocent Iraqi civilians, by the hundreds and thousands, from attacks that we thought we were immune to because we have this device."

These worthless devices were manu-

factured very cheaply and sold to the Iraqi government for $40,000 to $60,000 each. One can only wish that the procurement officials there had scientific minds and hadn't fallen for this pseudoscience.

Said one article: "The BBC reported that it had arranged a lab test of the device and found that its bomb-detection component was an electronic merchandise tag of the sort used to prevent shoplifting." The company's claim that the ADE 651 "can detect minute traces of explosives, drugs, or even human remains at distances of up to 6 miles by air, or three-fifths of a mile by land" is so clearly bogus to anybody with a scientific mind that the loss of perhaps thousands of lives through its use is outrageous.

The SKEPTICAL INQUIRER asked James Randi, who provided advice about testing such devices in the mid-1990s, for his perspective about the latest developments. Here's what Randi said:

> The original price paid for the device was a few thousand dollars, still a ridiculously high amount; the multiple Iraqi hands that it passed through elevated that price many times over. And, this exposure still leaves a few dozen other identical scam "sticks" out there, all making millions, and none of them working. The James Randi Educational Foundation directly offered the responsible Iraqi officials—including Major General Jehad al-Jabiri—our million-dollar prize, and *not one responded*. They didn't need the money, for obvious reasons. The U.S. government, the Homeland Security agency, also invested our tax money in these farcical tricks, and no U.S. agency has reacted to the exposure. After all, it's only tax money. . . .
>
> And, not only Iraqis died from the use of the ADE 651. Military forces, both Iraqi and American, suffered as well.

Failed tests of predecessor devices go back at least fifteen years. In 1996 *Dateline NBC*, after consulting with Randi, aired an exposé of the so-called Quadro Tracker, also known as the Positive Molecular Locator. The company that made it claimed it could find drugs, weapons, explosives, currency, drug users, and missing people from hundreds of miles away. It consisted of a retractable portable radio antenna mounted on a handle and was essentially a dowsing rod, sensitive to the subconscious hand movements of the operator. The Quadro Tracker was sold widely to police departments and school systems for $400 to $8,000.

Researchers at Sandia National Laboratories in Albuquerque, New Mexico, had examined that device in 1995 at the request of the National Institute of Justice (NIJ). "There are no electronics, motors, or any other electrical devices inside the handle," according to the Sandia report released by the NIJ (see SI, January/February 1997, pp. 20–21). Several months after the NBC report, a U.S. district judge granted a permanent injunction against the company saying it "engaged in a scheme to defraud" because "the defendants knew that there was no reasonable basis" for the company's claims.

In 2002 Sandia was asked by the National Law Enforcement and Corrections Technology Center, funded by the NIJ, to test a similar device, the MOLE programmable detection system, then marketed by a company in Kent, United Kingdom. It also had a radio-type antenna, and the company claimed it could detect a variety of substances, including explosives. A positive indication was said to occur when the antenna pivoted across the operator's body and pointed toward the target material.

Sandia designed and conducted a series of twenty double-blind experiments testing the claims. The MOLE performed no better than a random process (see "Sandia Tests MOLE Detector, Finds Only Chance Performance," SI, January/February 2003).

The published Sandia report noted that MOLE appeared "physically nearly identical" to the Quadro Tracker that Sandia had evaluated in 1995. The only visible physical differences appeared to be the product labels and the handle-programming chip—interchangeable on the Quadro Tracker, permanently fixed on the MOLE.

The latest reports from Iraq show that such pseudoscientific, costly, and dangerous deceptions have continued.

In a related story, an article by Marc Lacey in the March 16, 2010, *New York Times* reports that the police and the military in Mexico use similar "magic wands" for drug detection.

The article reports that the British government has notified the Mexican government that the device "may be ineffective." Still, the GT200 manufactured by the British firm Global Technical Ltd. is widely used at checkpoints in Mexico. "As of April 20, 2009, the army had purchased 521 of the GT 200 detectors for just over $20,000 apiece, for a total cost of more than $10 million." The product is reported to be similar to the ADE 651 manufactured by a different British company.

The article says that the British government is considering legislation to stop exports of the device.

The main good news in the article is that "the Drug Enforcement Administration in Washington said it did not use the handheld detectors."

Still, the article reports that government in Thailand uses them, arresting people based on what the detectors indicate. Human Rights Watch has protested.

So the problem with these modern-day divining rods is worldwide and widespread.

Jay M. Pasachoff is a professor of astronomy at Williams College where he teaches a course on "Science and Pseudoscience." He is a newly elected fellow of the Committee for Skeptical Inquiry. James Randi and Kendrick Frazier contributed to this article.

Vaccine-Autism Doctor Guilty of 'Dishonesty,' Study Retracted

Andrew Wakefield, the doctor whose research sparked international concern over whether vaccines cause autism, was found guilty by a British panel on January 28 of acting unethically in his research on autism (see also, "Autism-Vaccine Link Researcher Andrew Wakefield Accused of Faking His Data," SI, May/June 2009).

Wakefield was the lead author of a small-scale 1998 case report involving twelve children that posited a link between vaccines and the onset of childhood autism. The report was published in the respected medical journal *The Lancet* and sparked international concern over whether vaccines cause autism. A crusade against childhood vaccinations sprung up, led by actress and model Jenny McCarthy, who appeared on television and wrote books urging parents not to have their children vaccinated against deadly diseases based on Wakefield's now-discredited research.

According to an ABC News story, "The United Kingdom's General Medical Council concluded Jan. 28 that Wakefield participated in 'dishonesty and misleading conduct' while he conducted the 1998 research. Most of the findings against Wakefield are breaches of standard ethical codes meant to keep bias out of scientific journals."

Wakefield was found to have taken blood samples from children at his own child's birthday party without consent. Ironically, the inquiry also found that he had failed to disclose that he had a financial interest in a patent for a new measles, mumps, and rubella (MMR) vaccine he had in development.

After the panel released its findings, *The Lancet* reviewed Wakefield's original study and issued a complete retraction with the following statement: "It has become clear that several elements of the 1998 paper by Wakefield et al. are incorrect . . . in particular, the claims in the original paper that children were 'consecutively referred' and that investigations were 'approved' by the local ethics committee have been proven to be false. Therefore we fully retract this paper from the published record."

So far, Wakefield's ethical lapses have cost him only his reputation; he may also lose his license to practice medicine. But the real cost is the millions of dollars of research money spent trying to confirm his fraudulent claim. All those wasted years and dollars could have been spent on genuine, productive leads generated by ethical researchers. The true cost of Wakefield's dishonesty may never be known.

—Benjamin Radford

Benjamin Radford is the managing editor of the SKEPTICAL INQUIRER *and a CSI research fellow.*

Flamm Wins Final Court Battle in Prayer/Fertility Study Exposé

Bruce Flamm, the California physician/investigator who in articles in the SKEPTICAL INQUIRER and elsewhere exposed a questionable published study about intercessory prayer and fertility, has been vindicated in two recent court decisions.

The latest, in February, came when the California Supreme Court reviewed briefs and declined to hear the case. Kwang Cha, the Korean first author of the original report, agreed to pay approximately $100,000 to cover Flamm's defense costs.

The whole episode of this notorious Columbia University "miracle" study started in September 2001 when Cha, Daniel Wirth, and Rogerio Lobo published a widely publicized study in the *Journal of Reproductive Medicine*. They professed to have conducted randomized studies showing that prayer influences the success of *in vitro* fertilization-embryo transfer. Flamm and others immediately found problems with the study, and Flamm soon demonstrated that it was seriously flawed and possibly fraudulent.

A year later coauthor Wirth was indicted by a federal grand jury for criminal fraud in another case and was sentenced to federal prison two years later. In December 2004 third author Lobo, chairman of the Department of Obstetrics and Gynecology at Columbia University, admitted that he had not known about the study until six to twelve months after its supposed conclusion. He removed his name from the study.

Flamm requested but was never given any data verifying the study was conducted as reported, and in investigative articles in the *Scientific Review of Altern-*

ative Medicine and the SKEPTICAL INQUIRER (SI, September/October 2004, March/April 2005, and May/June 2007) reported the alleged study's serious flaws and its authors' various travails. In February 2007, for instance, the *Los Angeles Times* reported that Cha had been charged with plagiarism in still another fertility paper he published.

In August 2007 Cha sued Flamm for defamation. In June 2008 Los Angeles Superior Court Judge James Dunn threw out Cha's lawsuit and ordered Cha to pay more than $50,000 in defense costs. Cha then took the case to the California Court of Appeals.

On October 24, 2009, that appellate court "affirmed in full" the Superior Court decision and thus ruled that Superior Court Judge James Dunn had acted appropriately in tossing the lawsuit.

Flamm called that ruling "a victory for science and evidence-based medicine." He continued, "Scientists must be allowed to question bizarre claims. Cha's mysterious study was designed and allegedly conducted by a man who turned out to be a criminal with a 20-year history of fraud." Flamm said Cha, instead of defending his study with research data, hired a team of lawyers to punish him. "Physicians should debate their opinions in medical journals, not in courts of law. Judges have better things to do with their time and taxpayers have better things to do with their money."

The February 2010 decision by the California Supreme Court not to hear Cha's appeal effectively ends the case. "The legal nightmare is finally over," says Flamm. "This is a victory for science."

Yet even with Wirth in prison and Lobo disgraced, *Journal of Reproductive Medicine* editor-in-chief Lawrence Devoe has never retracted the discredited article. Flamm laments that the Cha/Wirth miracle report remains in the peer-reviewed medical literature, where it can still be mistaken as valid scientific research.

—Kendrick Frazier

Kendrick Frazier is editor of the SKEPTICAL INQUIRER.

Eugenie Scott Awarded National Academy's Public Welfare Medal

Eugenie Scott has worked tirelessly for years promoting the teaching of evolution in public schools and opposing creationist efforts to undermine it.

She has won many honors and accolades, including six honorary doctorates, the Society for the Study of Evolution's Stephen Jay Gould Prize, and our own Committee for Skeptical Inquiry's Public Education in Science Award (1991). But perhaps none is as significant as that recently announced by the National Academy of Sciences. The Academy has selected Scott to receive its Public Welfare Medal, "its most prestigious award." The Public Welfare Medal has been presented annually since 1914 to honor "extraordinary use of science for the public good."

Previous recipients include Carl Sagan, C. Everett Koop, and Nobel Peace Prize winner Norman E. Borlaug.

Scott, a physical anthropologist, is executive director of the National Center for Science Education, the nation's leading advocate for the teaching of evolution in public schools. She is also a CSI fellow and former member of the Committee for Skeptical Inquiry Executive Council.

"Eugenie Scott has worked tirelessly and very effectively to improve public understanding of both the nature of science and the science of evolution," said Ralph J. Cicerone, president of the Academy. "She makes the case for science again and again."

John Brauman, chair of the Public Welfare Medal selection committee, added, "We honor her for many years of organizing coalitions of scientists, parents, teachers, business people, clergy, and others to defend the teaching of evolution."

She will be presented the medal on April 25 during the Academy's 147th annual meeting in Washington, DC.

—Kendrick Frazier

Mr. Pringle Solves Crop-Circle Mystery

It's not every day that the solution to a worldwide "unexplained" mystery appears on primetime television—especially not in service of advertising potato chips. But a recent ad campaign from Pringles shows a group of fun-loving teens making crop circles and other patterns (including an image of the mustachioed Mr. Pringle) while, of course, munching on the delicious snack.

When I saw the commercial, I immediately recognized their techniques and equipment. The public's interest in crop circles peaked around 2002, after Mel Gibson's film *Signs* came out. Along with CSI Senior Research Fellow Joe Nickell and colleague Kevin Christopher, I conducted field experiments in crop-circle making in a field south of Rochester, New York (see "CSICOP Field Investigations: 2002 Crop Circle Experiments," *Skeptical Briefs* 12(3), and "Circular Reasoning: The 'Mystery' of Crop Circles and Their 'Orbs' of Light," SI, September/October 2002).

There are many ideas about what creates crop circles, from aliens to mysterious vorticies to wind patterns, but all the theories lack one important element:

good evidence. The public is largely unaware of the *real* way that crop circles are made, but the new Pringles commercial blows the lid off the secret.

Though many people believe that crop circles have been reported for centuries, they date back only about thirty years. The mysterious circles first appeared in the British countryside, and their origin remained a mystery until September 1991, when two men, Doug Bower and Dave Chorley, confessed that they had created the patterns for decades as a prank to make people think UFOs had landed. They never claimed to have made all the circles—many were copycat pranks done by others—but their hoax was responsible for launching the crop-circle phenomenon.

How did they do it? With the same techniques and equipment seen in the Pringles commercial: using homemade "stalk stompers" (wooden boards attached to rope) to lay the stalks in one direction. The process is not nearly as complicated as many people assume. The triple-circle crop pattern we made in 2002 was about 110 feet long by 80 feet wide and took only a few hours from start to finish, including breaks to photograph our results. It might have gone faster if we'd stopped to eat multigrain potato chips.

—Benjamin Radford

Benjamin Radford is an investigator with CSI and managing editor of the SKEPTICAL INQUIRER. *His book* Scientific Paranormal Investigation *will be published later this year.*

Miracle Coma Patient's Story Told via Facilitated Communication

In late 2009, a man named Rom Houben recovered from a coma. This was not a particularly noteworthy event, except that Houben had been in what doctors call a "persistent vegetative state" since 1983. But in 2006, a brain scan revealed that his brain was far more active than previously believed—despite his body being unable to move.

Houben's (partial) recovery surprised and intrigued many in the medical community, but even more amazing was the interview he gave to the German newspaper *Der Spiegel* about his life as a victim of "locked in syndrome."

Because Houben remains paralyzed, his account was written with the help of his speech therapist, Linda Wouters, who guided his fingers to a specially made keyboard. Wouters said that Houbens told her which letters to type with subtle twitches of his finger.

Houben's unique and inspiring story in *Der Spiegel* was a huge success, and he planned to work with Wouters to write a full-length book about his experiences in the same vein as Jean-Dominique Bauby, a previous patient with the same condition who wrote a book upon which the film *The Diving Bell and the Butterfly* was based.

But was Wouters helping Houben type or typing for him? This technique, called facilitated communication, was used in the 1980s and 1990s to help autistic children and others with limited communication abilities but was later proven bogus.

AP Photo/Yves Logghe

In this November 24, 2009, file photo, a facilitator helps Belgium's Rom Houben use his touchscreen to communicate during an interview at the service center Weyerke in Zolder, Belgium.

IGNITE THE ADVENTURE

The New Future Fund

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– Jacob Bronowski, scientific polymath

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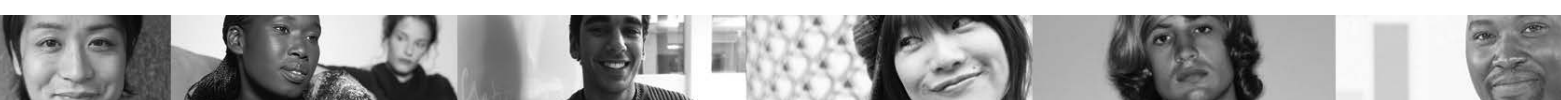
Toni Van Pelt, Paul Kurtz, and Ron Lindsay (standing); Lawrence Krauss, David Helfland, and Nobel Laureate Paul Boyer (seated) introduced the Declaration in Defense of Science and Secularism at the inaugural press conference of the Center for Inquiry/Office of Public Policy in Washington, DC.

Local leaders, campus activists, and students from around the world came together at CFI's Summer Session.

Latin American and U.S. skeptical activists met at the CFI-sponsored First Iberoamerican Conference on Critical Thinking in Peru.

The new Naturalism Research Project will more than double our library facilities and create a collegial setting for scholarly dialogue and research.



At first, Houben's neurologist, Steven Laureys, insisted that his tests showed that Houben, not Wouters, typed the man's words. Still, questions remained, and upon further testing Laureys reversed his position and concluded that Houben's words had not been his own. Tests conclusively proved this. In one test Houben was shown a series of objects and words to identify without his speech therapist present. When his therapist came into the room, he was asked to type the words he had seen moments earlier. The therapist had no way of knowing what the words were, and Houben could not type a single one.

Wouters (presumably unwittingly) created Houben's story out of thin air; she wrote what she thought he would say, probably believing that the words and ideas were coming from him. Thus all the words and the *Der Spiegel* interview were fictional—as his book would be.

A detailed report from the Belgian skeptics on their testing of Houben will appear in the next issue of SI.

—Benjamin Radford

Online Extra!
For more on this, see Willem Betz's article "Facilitated Communication with Coma Patient is Fabricated" at **www.csicop.org/SIExtras**.

CSI Investigation Used in University Critical Thinking Course

A comprehensive skeptical investigation into the best evidence for psychic detectives by CSI's Benjamin Radford (see "The Psychic and the Serial Killer," SI, March/April 2010) has been adopted for use in a university course on skepticism and critical thinking. The case involved a serial killer in 1982 New Jersey, his two victims, a psychic detective who claims to have given accurate information about the killer, and two police officers who support the psychic. The case received extensive publicity on cable television shows, in books, and on the Internet and was championed by Alex Tsakiris, host of a podcast called *Skeptiko*, as the "best case" for psychic detectives. Based upon this claim, Radford began a nine-month investigation to separate fact from fiction.

When Radford solved the mystery in late 2009, he was contacted by John Farquhar, a professor at Western Washington University who had followed the investigation. Farquhar requested the case's source materials (interviews, transcripts, copies of reports, audio interviews, etc.) for a course on skepticism he teaches as a model of how to investigate unusual claims. "The Nancy Weber case that you recently completed would be an excellent case for this purpose due to its complexity and the availability of rich resources," Farquhar said. Radford worked with Farquhar to develop the most effective way to present the information to his students to help them analyze paranormal claims and sub-claims, hidden assumptions, logical fallacies, types of evidence, and so on. Farquhar hopes to use Radford's "textbook example" of how to investigate paranormal claims in his freshman critical thinking course in 2010. □

Dear Friend of the Skeptical Inquirer,

We invite you to participate in a competition to design a NEW T-shirt for the Committee for Skeptical Inquiry (CSI) and the Skeptical Inquirer.

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2nd place will receive $250, T-shirts, and a complimentary subscription.

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Visit our Facebook page for more information about this contest (www.facebook.com/notes.php?id=55675557620).

Keep Libel Out of Science

EDZARD ERNST

About two years ago, the book *Trick or Treatment?,* which I coauthored with Simon Singh, was published in the United Kingdom. As this coincided with "U.K. Chiropractic Awareness Week," Singh supported the book's launch by publishing an article in the comment section of *The Guardian* newspaper. In it, he exposed many therapeutic claims made by the British Chiropractic Association (BCA) as not supported by anything remotely resembling sound evidence. In particular, the BCA claimed chiropractic is effective for childhood asthma, infant colic, otitis media, and other pediatric conditions. The BCA considered Simon's article to be libelous.

Several attempts to settle the issue out of court failed. *The Guardian*, for instance, offered to publish a rebuttal by the BCA, but the BCA refused and instead sued Singh personally for libel. So far, eighteen months into theses proceedings, Singh has had to fund over £100,000 in legal costs for his defense.

English libel law is fundamentally different from that of other countries. It reverses the burden of proof: the accused is guilty until proven innocent. Obviously this can be difficult, particularly when dealing with therapeutic claims and counterclaims. Yet Singh was optimistic—until a very surprising ruling by Judge Eady decided on the meaning of Singh's *Guardian* article. Partly because it contained the phrase "happily promotes bogus treatments," the judge ruled that Simon had implied that the BCA was deliberately promoting treatments that it knew were false. I know Singh well and therefore can affirm that he never meant his words to be interpreted in this way. A difficult situation had suddenly become much worse: Singh had to defend something he basically never wrote.

There was only one way out, it seemed: Singh had to appeal against Judge Eady's ruling. Fortunately, he won the right to do that, and on February 23, 2010, three of the most senior judges in the country heard the appeal, including the Lord Chief Justice and the Master of the Rolls. Apparently even the judges were surprised by what they called the "artificiality" of the case. One said, "I'm just baffled. If there is reliable evidence, why hasn't someone published it?" Their verdict is expected in April.

If the judges do ascribe the meaning to Singh's words that coincides with Singh's intentions, the libel trial can begin and the evidence for and against chiropractic will be in the dock as much as Singh. Alternatively, if they accept the BCA's interpretation, then Singh will have to prove dishonesty, something he never intended to write. Libel cases in England cost, on average, over one hundred times more than in mainland Europe. Going ahead with legal proceedings can therefore be ruinous, even to an organization such as the BCA. So perhaps there will be another chance for settling out of court.

The British Chiropractic Association's actions have seriously damaged the reputation of chiropractic, not just in the U.K. but worldwide.

In the meantime, the BCA's actions have seriously damaged the reputation of chiropractic, not just in the U.K. but worldwide. While most consumers might have looked upon chiropractors as some type of back-pain specialist, many are now more likely to see them as

Edzard Ernst, MD, PhD, is at the Peninsula Medical School, Universities of Exeter and Plymouth, Exeter, U.K. E-mail: Edzard.Ernst@pms.ac.uk.

a bizarre sect obsessed with an evangelic belief in the myth of subluxation and the "innate" life force, convinced that they can cure anything from asthma to bed-wetting. I would not be surprised if many BCA members grow disenchanted with their organization going into self-destruction mode, spending their money in the process.

The true significance of all this reaches far beyond the fate of Singh, the BCA, or chiropractic. English libel law is a serious threat to free speech in all walks of life. Libel cases typically cost $2 million and last a couple of years—this is certainly a possible scenario for Singh's case if it goes to trial. England's libel laws are not only expensive but also arduous, time-consuming, and one-sided. They do not serve the truth but merely favor the party that happens to have enough money to see the case through. Thus the laws have become a popular mechanism for silencing whistle blowers and other types of opposition.

The negative effects of English libel law can be felt everywhere. A buoyant "libel tourism" attracts cases from across the world to the English courts. As long as your opponent can demonstrate that he/she/it has a reputation in England and your allegedly libelous statement was available to an English audience, even if only via the Internet, English courts can be used to deal with a libel suit brought against you, regardless of where you happen to reside.

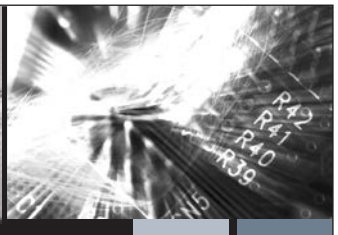
For example, when American author Rachael Ehrenfeld wrote *Funding Evil*, a book on the funding of terrorism, she was sued by a Saudi billionaire in London, even though only twenty-three copies of her book had been sold in the U.K. As a result of this case in particular, U.S. states one by one are passing legislation to block the impact of English libel judgments on American citizens.

Singh's libel suit is not unique in the area of medicine and health. I have been threatened twice with libel for publishing critiques of alternative medicines. Fortunately, in both cases, it came to nothing. Danish researcher Henrik Thompsen was sued recently by GE Healthcare, British health writer and doctor Ben Goldacre was sued for criticizing the promotion of vitamins to treat HIV, and currently Dr. Peter Wilmshurst is being sued for criticizing the data relating to a trial of a heart device developed by the American firm NMT. Wilmshurst will be bankrupted if he loses his case, but he is determined to fight on.

In the realm of medicine, the consequences can, of course, be particularly dire. If we cannot speak out against bogus practices, healthcare will suffer and patients will be put at risk. This is serious stuff! Most of my articles are now being read by lawyers, and editors regularly demand that I change them, or worse, they reject them on their legal advice.

I urge all readers to support our initiative to change this ill-conceived piece of legislation by signing up (www.libelreform.org). We have over 35,000 signatures already, but we need yours, too, wherever you live. □

SCIENCE AND THE PUBLIC



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Did a Cosmic Impact Kill the Mammoths?

The rise and fall of the theory that cosmic catastrophes altered human prehistory in North America.

DAVID MORRISON

The Impact Hypothesis

Ever since the Alvarez (1980) hypothesis that the end-Cretaceous (Cretaceous-Tertiary or KT) mass extinction was the result of a cosmic impact sixty-five million years ago, the idea of killer asteroids or comets has been frequently discussed. The stunning confirmation of the KT impact initiated a revolution in our thinking about possible external events and their effects on biological evolution. David Raup of the University of Chicago famously proposed that perhaps all major mass extinctions were impact induced. He even published a "kill curve," suggesting that lesser extinctions might be the result of smaller impacts. Unfortunately for those of us who sought a general explanation for mass extinctions, these broader suggestions have not been verified. It seems increasingly likely that cosmic impacts are only one of several catastrophic events that have produced mass extinctions. Still, the discovery that an impact sixty-five million years ago led to the extinction of the dinosaurs remains one of the iconic ideas of late twentieth century science.

David Morrison is a NASA space scientist and fellow of the Committee for Skeptical Inquiry. For two decades he has closely followed the evolving science of cosmic impacts, including studying ways to protect our planet from future hits. He is a recipient of the Carl Sagan Medal of the American Astronomical Society for popular science writing, and asteroid 2410 Morrison is named in his honor.

The most dramatic recent hypothesis linking extinctions with impacts was proposed in 2007 by a team of twenty-six scientists, led by nuclear chemist Richard Firestone of Lawrence Berkeley National Laboratory, with independent geophysicist Allen West; geologist James Kennett of the University of California, Santa Barbara (a member of the National Academy of Sciences); and archaeologists Douglas Kennett and Jon Erlandson of the University of Oregon. In a widely reported presentation at a joint assembly of the American Geophysical Union (AGU) in Acapulco, Mexico—followed a few months later by a paper in the *Proceedings of the National Academy of Sciences* (*PNAS*)—these scientists proposed a cosmic origin for a geologically recent event, the extinction of many large mammals (megafauna) in North America approximately 13,000 years ago. The events they linked were the presence of a dark soil layer that coincided with the extinction of megafauna (including the mammoth and mastodon), the end of the Clovis culture (identified by its large and well-made spear points), and the start of the Younger Dryas (YD) cool period (a millennium pause in the general warming at the end of the last ice age). The *in situ* bones of extinct megafauna, along with Clovis stone tools, occur below this black mat but not within or above it. At this boundary the team reported finding enriched levels of iridium and other signatures of extraterrestrial material.

In a sweeping conclusion reminiscent of the Alvarez hypothesis, Firestone and his colleagues postulated that these events were tied to one or more cosmic impacts over North America, releasing energy they estimated at about ten million megatons (equivalent to an impacting comet four kilometers in diameter). They suggested that an airburst and/or surface impact by a dense swarm of carbonaceous asteroids or comets set vast areas of the North American continent on fire. This swarm would have exploded above or even into the Laurentide Ice Sheet north of the Great Lakes. Such an airburst would have been a million times larger than the Tunguska impact event of 1908.

Scientific Reactions

While archaeologists pondered the reality of this sharp boundary layer and the new evidence of extraterrestrial materials, a few astronomers and impact experts immediately questioned this scenario. They noted that there was no mechanism to hold such a dense swarm of impactors together in space. To the suggestion that a large comet had broken up just before hitting Earth, they replied that this lacked a physical mechanism. If the comet had shattered when it encountered the atmosphere at an altitude of

about one hundred kilometers, the lateral dispersion would be at most tens of kilometers, hardly enough to distribute the effects across North America. An alternate suggestion was that this event was analogous to the 1992 tidal breakup of comet Shoemaker-Levy 9, which resulted in the separate impact of about twenty-three fragments on Jupiter two years later. However, these comet fragments were spread over more than a million kilometers in space, and the impacts were distributed over all longitudes on Jupiter. While it is true that some comets have been seen to spontaneously disintegrate in space, the chances of this happening just before an impact with Earth is negligible—something that might have happened at most once in the past four billion years. There was apparently no way to get a swarm of impactors to target North America alone.

One of Firestone and his colleagues' suggestions that troubled geologists and impact experts was that the same event (or a similar one) might have been responsible for the Carolina Bays geologic formation. The Carolina Bays are several hundred thousand shallow, elliptical depressions of disputed origin along the U.S. eastern seaboard. Firestone suggested that each of these more than 100,000 features was the result of a cosmic impact. Since the well-known Tunguska airburst in Siberia in 1908 did not form a crater, the implication is that these were made by larger objects that reached the ground. But calculation of average impact frequency suggested that only about one super-Tunguska could be expected to hit Earth in the past 13,000 years. The chances of two such extremely unlikely swarm impacts happening within the past few thousand years is worse than negligible.

A warning of the problems with this hypothesis should have been apparent to anyone who read 2006's *The Cycle of Cosmic Catastrophes: Flood, Fire, and Famine in the History of Civilization* by Richard Firestone and Allen West, with writer and publicist Simon Warwick-Smith. This trade book, which appeared a year before Firestone's AGU presentation, described the YD impact hypothesis as part of a much larger cycle of cosmic events. This book develops Firestone's 2001 suggestion that a cosmic ray catastrophe, probably caused by a supernova, occurred in northeastern North America in the late Pleistocene. He concluded that massive thermal neutron irradiation radically altered the radioactivity of terrestrial materials and

"probably figured in the mass extinction of Ice Age fauna." In *The Cycle of Cosmic Catastrophes*, Firestone links the YD impact to this postulated nearby supernova, which he asserted took place 41,000 years ago and initially devastated most life in Asia. Then 34,000 years ago the shock wave from this supernova initiated another wave of intense cosmic bombardment of Earth. The only evidence for this event is the remarkable claim that mastodon tusks from about that time are pitted with cosmic dust, suggesting that these animals received the direct blast of supernova material striking Earth (unstopped, apparently, by our atmosphere).

In *The Cycle of Cosmic Catastrophes*, the debris cloud from the supernova is supposed to have reached Earth about 13,000 years ago. The YD impact was one manifestation of this blast wave, bathing the planet in radioactivity and destabilizing the magnetic field. In this book the authors suggest that the Carolina Bays were created by secondary impacts of ejecta from the main hit in the North American ice sheet. To produce this much ejecta, the hit must have been among the most catastrophic events in Earth's history. They suggested that the YD impact excavated Hudson Bay, making it larger than the KT impact of sixty-five million years ago, which is estimated to be a once-in-one-hundred-million-years event. Yet supposedly this huge hit did not produce a worldwide mass extinction but influenced only the megafauna of North America. This entire scenario is inconsistent with what astronomers know about supernovas, which Phil Plait summarized in his recent book *Death from the Skies*. It raises serious questions about the reliability of the *PNAS* paper that Firestone and West, with two dozen additional authors, published a year later.

New Data and Continued Controversy

In January 2009, Doug Kennett published a paper in *Science* asserting that nanodiamonds provide the strongest evidence for the impact hypothesis, with multiple airbursts and impacts at the onset of the YD cooling. He argued that these nanodiamonds were produced in the moderate shocks associated with comet airbursts. By this time, earlier claims about iridium enrichment and other possible impact markers had been withdrawn. The usual geological evidence of large crater-forming impacts such as the KT, namely shocked quartz, had never been reported at the YD boundary sites. Now the nature and origin of nanodiamonds became the primary issue.

There were a variety of claims and counterclaims concerning the nanodiamonds. Were they produced in the impact, or were they primordial material trapped in the comet when it formed billions of years earlier? Most impact experts agree that nanodiamonds were unlikely to have been formed in the impact. In fact, Mark Boslough of Sandia National Laboratories calculated that the high temperatures and pressures in a large impact would likely destroy existing nanodiamonds. Some note that nanodiamonds are actually ubiquitous on Earth and can even be formed in fires. One scientist joked that perhaps the nanodiamonds were concentrated at human habitation sites where hunters were roasting the meat from mammoths and mastodons. The history of these claims and counterclaims is well documented in articles by *Science* journalist Richard Kerr published in 2007, 2008, and 2009.

At a meeting of the Geological Society of America (GSA) in October 2009, several presentations argued strongly against the YD impact from a variety of perspectives (see GSA summary in references). One paper claimed that the black mats at the YD boundary were not charcoal from widespread fires but rather peat-rich dark soils formed during a wet period. Another speaker noted that there was no archeological evidence for a sudden decline in the human population of North America at the YD. While one speaks of the end of the Clovis culture, this only means that the style of stone tools changed. We don't know why, although one possibility is a shift to hunting smaller animals. Other scientific teams reported that their efforts in the field to find nanodiamonds or other impact markers at the YD boundary layer were unsuccessful.

Some impact proponents who were not present at the GSA meeting wrote blogs and circulated e-mails accusing these scientists of sloppy fieldwork. They asserted that the boundary layer was very thin and rather spotty in distribution, requiring care to find it—care they implied had not been exercised by their critics. The GSA session resulted in the undercutting of the credibility of the original *PNAS* and *Science* papers, but since the two sides did not confront each other directly, nothing was settled.

The American Geophysical Union Symposium

Given the conflicting interpretations concerning a possible YD impact catastrophe, many scientists thought a debate between proponents and critics might help clear the air. The YD impact hypothesis had been discussed for more than two years without any common ground emerging. Indeed, the original team of twenty-six scientists was itself fragmenting, with only Richard Firestone and Allen West still strongly advocating the original multi-comet impact scenario. Mark Boslough of Sandia worked with Allen West to organize a symposium at the 2009 fall meeting of the AGU, with speakers from both sides. While no one expected that public discussion would lead to reconciliation, the organizers hoped this symposium would at least focus on the main issues.

The December 2009 AGU session topic was "Younger Dryas Boundary: Extraterrestrial Impact or Not?" Ten speakers were squeezed into a single two-hour session, including Allen West, impact specialist Peter Schultz of Brown University, and former NASA geoscientist Ted Bunch from among the original *PNAS* authors. Firestone chose not to attend. There was standing room only at the session, and several hundred others were turned away at the door.

The star of the event was Wally Broecker of the Department of Earth and Environmental Sciences at Columbia University. Broecker is one of the most respected environmental scientists in the world. Credited with first describing the ocean current conveyer belt and inventing the term "global warming," his honors include membership in the National Academy of Sciences and award of the Presidential Medal of Science. His presentation was sober and low key, but he made it clear that he was unconvinced by the evidence for an impact or any catastrophic change at the YD boundary. But rather than condemning the hypothesis, he stated simply that the decline in the North American megafauna could be understood as a result of climate change and overhunting—the conventional explanation. Broecker said, "We do not need the impact hypothesis."

Most of the speakers who followed Broecker restated positions that were already on the record. West and his colleagues repeated their evidence of extraterrestrial markers in the black mat at the YD boundary, with emphasis on the presence of nanodiamonds. They suggested several possible impact scenarios, such as oblique impact on the ice sheet, but admitted that there were many uncertainties. Several critics reiterated that the proposed impact is highly unlikely statistically and that an airburst as large as proposed is inconsistent with our understanding of comets and the impact process.

The most interesting new results were presented by Jacquelyn Gill, a graduate student in the Department of Geography at the University of Wisconsin–Madison. She has been studying lake sediments that contain spores of sporomiella (a fungus that occurs in herbivore dung) in the time

range around the YD. This fungus is related to the total mass of herbivores and can be used as a proxy for the megafauna population. Her data show a gradual decline, beginning well before the YD marker and extending beyond the end of the Younger Dryas cool period. Indeed, in some isolated locations mammoths and mastodons did not go extinct until much later: there were dwarf wooly mammoths on Wrangle Island in Alaska until about four thousand years ago. Some large North American mammals did not go extinct at all, including the bison, the moose, and the grizzly bear. Gill's results seem consistent with the worldwide evidence that rapid declines in large mammal population accompanied the arrival of early human hunters, presumably as a consequence of overhunting.

Unfortunately, the overcrowded session ran late, and there was no time for discussion or questions. Even when their conclusions were challenged, most of the scientists in the audience chose not to respond. The result was a lost opportunity for real debate. Perhaps not surprisingly, the AGU session received very little press attention. Indeed, following the AGU and GSA meetings, the YD impact hypothesis seems to have retreated into the obscurity of a few e-mail list-serves and blogs, such as "The Cosmic Tusk" where George Howard (one of the original *PNAS* authors) is presiding over a variety of catastrophist interpretations of Holocene history.

Conclusions

It is instructive to compare the trajectories of the YD and KT impact hypotheses, as there are close parallels. Both research teams were led by nuclear scientists (Luis Alvarez and Richard Firestone) from the University of California, Berkeley. Both challenged the orthodoxy of mass extinctions. Both postulated an environmental catastrophe triggered by a large cosmic impact. Both were published initially in prestigious journals (*Science* and *PNAS*). They each presented a grand synthesis, not only identifying evidence of extraterrestrial materials at the extinction boundary but also proposing a broad impact scenario to explain a wide variety of previously unrelated data. And both ideas were initially resisted by the "old guard" of paleontologists and archaeologists.

While each hypothesis encountered initial resistance, the KT impact theory also gained enthusiastic support (see popular accounts by Walter Alvarez and James Powell). The first confirming paper was published within weeks, and soon multiple impact markers had been identified at a number of additional exposures of the KT boundary. Astronomers and geologists praised the paper and provided context by estimating the impact rate for ten-kilometer comets and asteroids. Atmospheric scientists such as Brian Toon and Kevin Zahnle of NASA Ames Research Center calculated the dispersion and lifetime of dust ejected into the stratosphere by the impact. Paleontologists like Peter Ward (University of Washington)—who initially argued for a gradual decline of populations—gathered new field data and used modern statistics to support an abrupt extinction at the KT boundary. Within three years the first of a series of Snowbird Conferences was held, bringing together top scientists to discuss the role of cosmic impacts on the evolution of life. The idea of an impact extinction gained early and continuing currency in the press.

In contrast, efforts by other scientists to confirm the presence of impact markers at the YD boundary have so far been unsuccessful. Astronomers, rather then welcoming the impact idea, have raised serious objections to the proposal by Firestone and colleagues. New data on megafauna extinction, such as the work of Gill, point to a gradual decline. Archaeologists emphasize that changing styles in stone tools do not demonstrate a sudden shift in human populations at the start of the YD but merely a change in technology or hunting style. In the aftermath of the 2009 GSA and AGU meetings, the press seems to have lost interest, and continuing support for the YD impact comes mostly from blogs by catastrophists who have long advocated cosmic intervention in human history.

Even without considering the technical issues at stake, there are two clues that something is amiss with the YD impact hypothesis. First is the 2006 book *The Cycle of Cosmic Catastrophes*, which formulates the YD hypothesis within the context of catastrophist pseudoscience. If more scientists and science journalists had been aware of this earlier publication when the YD hypothesis was first published in *PNAS*, it might never have gained traction. Second is the absence of confirming or supporting papers by scientists who were not members of the original team. A good hypothesis naturally accretes confirmation and gets better with time, as did the Alvarez KT impact hypothesis. Firestone's work has not done so.

It seems clear that the YD impact proponents were trying to follow in the footsteps of the Alvarez team, discovering evidence of a sudden extinction event and linking this to an extraterrestrial impact. However, the story isn't working out that way, and the impact they propose seems to be virtually impossible. One parallel that troubles me, however, is that the reaction of the traditionalists—scientists who say that the megafauna were in decline anyway and "we don't need an impact"—rather closely echoes the reaction of many old-guard scientists to the KT impact hypothesis. There also may be philosophical and political overtones that influence the reception given any proposal that deals with early human history. There is a long tradition of catastrophist ideas, going back to the biblical flood and Plato's story of Atlantis. Philosophically, many people prefer the idea that humans have not had much effect on the planet, either 13,000 years ago or today—better to blame thunderbolts from the gods than to accept responsibility for our stewardship of Earth. □

Acknowledgments

I am grateful to Mark Boslough, Clark Chapman, and Alan Harris for many stimulating discussions of the YD impact hypothesis and especially for their insightful and generous suggestions for improving this paper.

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When Scientists Actually Change Their Minds

MARK BOSLOUGH

As a graduate student in 1980, I was interested in impact cratering. I had just finished reading the comet catastrophe novel *Lucifer's Hammer* when Luis Alvarez, the famous physicist from Lawrence Berkeley, came to Caltech to present a colloquium on his group's asteroid hypothesis. It made so much sense. What else but an impact could possibly cause a global climate catastrophe and mass extinction?

Many years later, I read an article that featured Wallace Broecker, the Columbia University scientist with revolutionary ideas about catastrophic climate change caused by abrupt slowdowns in ocean circulation. I was fascinated by his idea that the rapid onset of the Younger Dryas cold spell could have been caused by the collapse of an ice dam and a deluge of freshwater into the North Atlantic that shut off the Gulf Stream, stopping the flow of tropical heat to the northern continents and plunging them into ice-age conditions. He showed that there could be other causes of global catastrophes that don't involve impacts.

I was delighted when Broecker agreed to give the opening presentation at the American Geophysical Union (AGU) session I helped organize, but I was surprised to learn that he had abandoned his famous hypothesis about the cause of the Younger Dryas. He started his presentation by reminding everyone that he used to argue that it was triggered by the flood from the ice-age Lake Agassiz, but when he flew over the route the floodwaters should have followed, he saw no geomorphic evidence for a flood. He had changed his mind!

His primary objections to the impact hypothesis were the same as his objections to the flood he had previously championed as the explanation: lack of evidence and lack of uniqueness of the Younger Dryas. Abrupt changes in climate, both warming and cooling, have happened many times, and Broecker argues that the climate system is inherently unstable. Why should only one of a long sequence of changes have such an improbable and catastrophic trigger event—whether impact or flood—when the climate system has repeatedly undergone such changes all by itself?

In his 1987 CSICOP address, Carl Sagan said, "In science it often happens that scientists say, 'You know that's a really good argument; my position is mistaken,' and then they actually change their minds and you never hear that old view from them again. . . . I cannot recall the last time something like that has happened in politics or religion."

Broecker's esteem among scientists was not diminished when he changed his mind. The Younger Dryas impact proponents would do well to follow his example.

Mark Boslough was co-organizer of the AGU Younger Dryas session in December. He is a physicist at Sandia National Laboratories and an adjunct professor at the University of New Mexico.

Abductions or Hoaxes? The Man Who Attracts Aliens

I was queried by ABC News about an alien video that subsequently aired on the ABC show *Primetime: The Outsiders* (August 18, 2009). The documentary focused on the personal experiences of a few people who believe they have been abducted by aliens, as well as on certain physical evidence, offered by one alleged abductee, that purports to prove alien visitation.

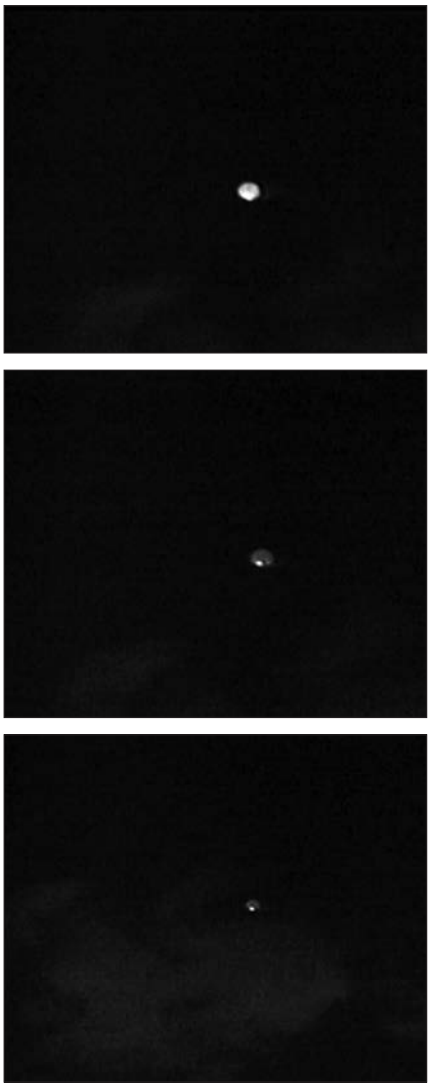
The reported experiences were consistent with other abductees' reports. Many of the abductees have simply had common "waking dreams," which occur in the borderland between wakefulness and sleep. Others have been hypnotized by alien-abduction gurus like the late Dr. John Mack and therefore have merely gone on a trip to Fantasyland that can conjure up false memories. Some of the more elaborate experiences happened to subjects (like Whitley Strieber, author of *Communion*) who, though sane and normal, nevertheless exhibit many of the traits of fantasy-prone personalities: being easily hypnotized, having vivid memories, experiencing intense dreams, and having out-of-body experiences, among others (Nickell 2007, 251–258; Baker 1987–88). A few alleged abductees may be psychotic, while others seem so craving of attention that they have turned to hoaxing.

Joe Nickell, CSI's senior research fellow, is a former magician and detective. He is author of many books, including Entities *and* Adventures in Paranormal Investigation. *His Web site is at www.joenickell.com.*

The physical evidence was offered by Stan Romanek, forty-six, who claims to have had contact with extraterrestrials since 2000. Indeed, if he is to be believed, he serves as a virtual magnet for extraterrestrial attention and has been getting quite a bit of terrestrial notice too—not all of it favorable. Living on disability income, he spends much time actively promoting the notion that aliens are fascinated by him. His obsession began when he caught on video a UFO that was witnessed by others at a park on the outskirts of Denver. Romanek also offers a video of an alien peering in his window and an X-ray showing an alien "implant" in his leg.

On *Primetime: The Outsiders* he was supposedly hypnotized by Leo Sprinkle, a psychologist who studies abductees and contactees. (Formerly of the University of Wisconsin, Sprinkle was asked to leave his position when colleagues found his work unprofessional and unscientific [Chang and Dubreuil 2009].) Under hypnosis, Romanek, who claims to have only a fifth-grade proficiency in math, wrote out a high-order mathematical sequence known as Drake's equation (an astrophysics formula approximating the number of planets in the Milky Way galaxy that could have intelligent life) (Chang and Dubreuil 2009).

To a professional mathematician, the equation feat seemed no more than memorization by an amateur. When ABC News asked Romanek for an inde-



Figures 1–3. Frame sequence from questioned UFO video. Frames 1 and 2 show flashing consistent with a commercially available strobe light carried by a small balloon. In Frame 3, sampled four seconds later, the object has decreased appreciably in size. (Frame analysis by Tom Flynn)

pendent medical assessment of his alleged implant, he claimed it had suddenly disappeared (Chang and Dubreuil 2009).[1] As for the videotaped alien, which Romanek named "Boo," a reporter appropriately described it as resembling "one of the glow-in-the-dark heads I got when I was in Roswell, New Mexico" (Meadow 2009). It certainly embodies the stereotypical likeness—the big-eyed, big-headed little humanoid that has evolved in popular culture and is seen in toy stores (Nickell 2001, 160–163). Romanek's alien provoked many parodies on the Internet.

Romanek's wife seems extraordinarily credulous, though she insists she is not. It is difficult to keep a straight face when you hear her say: ". . . when all your [TV] remotes in your house disappear for three days and you have searched everywhere, and then you wake up the next morning and they're all lined up on the counter, that's something I can't explain when I've searched for them." Less naive people would surely look not to aliens but to nearby terrestrial beings for suspects.

To assess Romanek's UFO video, I turned to my colleague Tom Flynn, a video expert, who treated me to a frame-by-frame analysis. He noted that the object was below clouds and appeared to pick up "illumination from ground sources such as street lights," suggesting it was rather low-flying and small, which was further suggested by its apparent rate of motion relative to the camera. As Flynn explained:

> A very large object would have to move at a very high rate of speed to display the apparent motion seen in this clip. A smaller object, which would be correspondingly closer to the camera, could display the same apparent rate of motion if it were simply drifting on a modest breeze, particularly if it had been quite close to the camera at the beginning of the shot.

Flynn concluded:

> Given the modest amount of visual evidence, many other explanations are possible. But in my opinion the imagery of this just over 11-second clip is *consistent* with a translucent, slightly underinflated balloon between 2' and 6' in diameter that carries or contains two light sources: one circular whitish constant light source, and one flashing red strobe with a period of 8–10 flashes per second, released from a position to the left of camera prior to the shot and allowed to drift overhead on a wind blowing from the videographer's left.

He characterized the red flashing light as "similar to emergency strobes found on some toys, camping lanterns, and the like" (Flynn 2009; see figures 1–3).

In short, the evidence provided by Stan Romanek that purports to prove he has been repeatedly visited or contacted by extraterrestrials is all of a doubtful, even suspicious, nature. I cannot distinguish it from hoaxing. Romanek, who is reportedly working on a feature film, asks of the entities, "Are they from a different planet? I can't tell you. I know they're not human, whatever they are" (qtd. in Chang and Dubreuil 2009). The evidence would appear to indicate that they, and their craft, hail from the familiar planet Latex. □

Acknowledgments

I am grateful to CFI colleagues Henry Huber, Tom Flynn, and Tim Binga for their help with this investigation.

Note

1. For more on alien implants, see Nickell 2001, 204–205.

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CAMP INQUIRY 2010
Young Minds, Big Questions

July 18–24, 2010 www.campinquiry.org

The Center for Inquiry is pleased to announce its 2010 summer program for children ages seven to sixteen.

In its fifth year, **Camp Inquiry** will take place from July 18 through 24 at Camp Seven Hills in Holland, New York.
The site boasts 620 acres of woodland paths, meadows, streams, and hills perfect for outdoor exploration.
Camp Seven Hills is fully insured and accredited with the American Camp Association.
With its impressive 5 to 1 camper to counselor ratio, Camp Inquiry is run by a staff of fully screened and trained teacher-counselors, including a trained medical professional.

This year's theme is "Young Minds, Big Questions." Who am I? Why am I here? What can I know? What ought I to do?
Campers will explore where we fit in the cosmic narrative offered by cosmology, evolutionary science, and neurobiology.
Camp Inquiry helps youth confront the challenges of living a nontheistic/secular lifestyle
in a world dominated by religious belief and pseudoscience.

How to Test a Miracle

A few years ago, my colleague Luigi Garlaschelli and I were asked if we would be interested in testing a twenty-two-year-old mystic woman who talked with the Virgin Mary and could create supernatural phenomena.

Debora Moscogiuri was a mystical seer living in Manduria (Taranto) in southern Italy. During ecstatic periods, she could supposedly see and receive messages from the Madonna, which she would then deliver to worshippers. Other phenomena were said to take place in and around the seer's home, including religious icons (pictures and statues) allegedly weeping blood. As is usually the case, none of these phenomena had been carefully investigated or documented, nor were DNA tests performed to ascertain the origin of the blood.

In 1995 one of Moscogiuri's statues of the Virgin Mary allegedly began to drip olive oil. Sealed containers, such as small bottles or jars, left in the proximity of the statue were later found to be partially filled with oil. These had been tied with ribbons, taped, sealed with wax, and placed inside plastic bags. At Moscogiuri's request, some olive leaves were placed inside the bottles before they were sealed.

This phenomenon was reproduced when Dr. Giorgio Gagliardi, a physician from Milan, prepared two such wax-sealed containers: one was kept in his office and a second identical one was sent to Manduria, which was returned to him weeks later with some oil in it—still sealed. Nothing had happened inside the jar kept in Milan. Realizing that wax and tape seals are inadequate against tampering, Gagliardi asked us about secure, "tamper-evident" containers.

Massimo Polidoro is an investigator of the paranormal, lecturer, and co-founder and head of CICAP, the Italian skeptics group. His Web site is at www.massimo polidoro.com.

Evidence of Tampering

When testing psychic claimants, it is sometimes necessary to allow the subject to take some target material away from the laboratory in order to try and obtain a psychic effect on it in his home. Until a short time ago, the importance of using foolproof containers when conducting this kind of experiment was not fully recognized. Consider, for example, the naiveté with which some parapsychologists investigated the claimed psychokinetic powers of children and teenagers in the past. Since children and teenagers were thought unlikely (or unable) to cheat, they were too readily left alone with target material, such as spoons or pieces of metal to bend. Then, when bends were found in the material, psychic investigators immediately assumed that some kind of psychic force was at work. Later investigations showed these suppositions to be wrong, and now stricter controls are (or should be) used when testing psychic claims.

Preparing "fool-proof" containers (e.g., bags, envelopes, or boxes), which do not allow the subject access to the item contained inside, has always been a challenge. However, preventing access to the item (e.g., by placing it in a steel safe) is probably not as important as making sure that the container is "tamper-evident," meaning it is prepared in such a way that any improper attempt to open it can be easily detected. Special security items are now used to this end. The old sealing wax, for example, has been replaced by self-adhesive labels that show signs of physical tampering, such as attempts to peel it off or the application of heat or solvents. These strips also carry unique identification numbers, used to determine when someone has replaced a strip with a duplicate after opening the container.

Sealing the Tubes

Returning to our investigation of Debora Moscogiuri, Luigi and I confirmed with Gagliardi that the kind of seals he had used could be easily opened and later replaced. Therefore, we prepared a set of sealed test tubes as follows: a) an olive leaf was put into each glass test tube; b) the tubes were flame-sealed on a Bunsen burner, taking care not to scorch the leaf inside; c) each tube was numbered in several positions using a vibrating glass-etching instrument; d) each tube was checked for invisible gaps by holding it under water (in such conditions small air bubbles would escape from those

imperfectly sealed); e) the tubes were weighed on a precision lab balance (tared just prior to this operation), recording all digits within a milligram of precision; f) each tube was then photographed with additional close-up lenses to record the etched number and shape of the sealed tip, where the glass had been melted.

When these tubes were slightly heated, the leaf inside gave off a few tiny droplets of water. The general look was quite different from that of oil, the total weight of course did not change, and the droplets were re-absorbed after a few days. Thus we decided not to worry about this detail. Each tube could then be identified by its weight and photograph, and each was "tamper-evident," as there is no way that glass can be melted and resealed exactly in its original shape.

Eight of these vials (numbered 1, 2, 3, 4, 6, 7, 8, 10) were delivered to Moscogiuri through Gagliardi and Father Civerra, a Catholic priest who followed the seer. We did not know the whereabouts of the sealed tubes, nor what was happening to them at the other end of Italy.

Surprise, Surprise!

Two notable events followed. We received news from Civerra, wherein he reported a mystical vision by Moscogiuri of the Blessed Virgin: she had seen a large tongue of flame (of the Holy Ghost) approach the tubes and take one of them away, leaving just seven (the number of the Virgin's sorrows). Later, there was speculation that some of our tubes contained oil.

Through the intermediacy of Gagliardi and Civerra, we managed to get our tubes back. We then examined them during a videotaped meeting attended by both Gagliardi and Civerra. Afterward, all participants signed a statement of the results. Civerra had put the tubes we had prepared into a jar and then into a plastic bag; each of these containers had been wax-sealed. For the reasons given above, we disregarded these extra security measures and requested that only our tubes be taken out and checked. It should be noted that when asked, Civerra admitted that he had no way of verifying whether his wax seals had been tampered with and replaced.

It turned out that: a) one of the eight tubes (number 3) was missing; b) tubes 1, 2, and 7 were intact and did not contain any liquid; c) tube 4 had a broken tip that had produced a small gap, but no liquid was present; and d) tubes 6, 8, and 10 contained a yellow viscous liquid.

A comparison with the photographs of the originals showed that the tips had been melted and resealed. The shapes of the tips were clearly different. One of the tubes had been tampered with on the side, and the glass was deformed, leaving a large bubble. One tip was also slightly cracked. All three of these phials contained traces of a black substance, and the leaf was partially or completely carbonized.

It was quite apparent that some crude tampering had occurred, which was indicative not of a miracle but, on the contrary, of some sort of fraud carried out by somebody in Moscogiuri's group. However, Civerra did not accept our suggestion of fraud, claiming that he placed more trust in his own external wax seals and that any deformity in the tubes was due to the "Holy Ghost's flame" in Moscogiuri's vision.

Despite Civerra's claim, we concluded that such flame-sealed glass test tubes—prepared with the few simple control procedures described above—could actually be a useful tool in the hands of researchers testing psychokinetic abilities.

As for Debora Moscogiuri, it appears that she still claims to have visions and periodically receive messages from the Virgin Mary, but strangely enough, materializations of oil inside containers no longer take place. □

Acknowledgment

This study would not have been possible without the work of Luigi Garlaschelli.

Skeptical Inquirer News

THE MAGAZINE FOR SCIENCE AND REASON

Announcing New Online SKEPTICAL INQUIRER Newsletter

The Committee for Skeptical Inquiry and the SKEPTICAL INQUIRER magazine have created one more way for readers to keep up with news and events. The inaugural edition of the electronically delivered *Skeptical Inquirer News* (yes, SIN) launched December 17, 2009. With this free monthly e-news publication, CSI will keep readers updated on new material, activities, and events of interest to the skeptical community.

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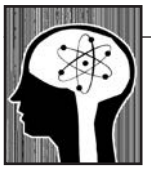

Philosophers against Evolution?

In 2009 we celebrated the 150th anniversary of the publication of one of the most influential books in the history of humanity, Charles Darwin's *On the Origin of Species*. In the midst of hundreds of articles, conferences, and books that marked the occasion (it was also Chuck's two-hundredth birthday), most people missed another interesting anniversary: fifty years since the publication of C.P. Snow's *The Two Cultures*, an essay in which the scientist-turned-humanist severely chided his fellow humanists for scoffing at modern science without understanding it, an attitude that Snow thought was both anti-intellectual and positively dangerous for society.

Of course, the anti-intellectual distrust between the two cultures runs both ways, as shown by the infamous "Against Philosophy" essay by Nobel physicist Steven Weinberg, who asked exactly the wrong question while wondering what scientific problem has ever been solved by philosophy. (This is like asking how many screws you put in place using your hammer; philosophy is not in the business of solving scientific problems, for which we have science.)

The latest round of nonsense from the culture wars comes, rather surprisingly, at the hand of a well-known philosopher, Jerry Fodor of Rutgers University, and a scientist, Massimo Piattelli-Palmarini of the University of Arizona. Fodor is well known in philosophy of mind as an iconoclast, and I have often enjoyed his barbs aimed at simplistic versions of the so-called computational theory of the mind (his booklet *The Mind Doesn't Work That Way* is a direct response to Steven Pinker's *How the Mind Works*), but this time he and Palmarini are off the mark, and they are not doing any favors to either science or philosophy.

Fodor and Palmarini's *What Darwin Got Wrong* gets off on the wrong foot by talking about "Darwinism," a code-word popular among creationists, which is not an actual scientific theory in current use within the biological community—just like physicists these days don't talk of "Newtonianism." They then proceed to make two broad arguments against their straw man: a biological one (I assume largely the work of Palmarini, who, incidentally, is not a biologist but a cognitive scientist) and a conceptual one (where Fodor's hand is most visible). The two authors do make several interesting points and touch on significant cutting edge empirical and theoretical issues in evolutionary biology. But instead of attempting to build on the existing foundations of the field (as the many authors of the forthcoming *Evolution: The Extended Synthesis*, which I have co-edited, have done), they take the "radical" path and reject a century and a half of solid science in little more than 150 pages. This is one of the most irritating things about the book.

Fodor and Palmarini take the "radical" path and reject a century and a half of solid science in little more than 150 pages.

Consider first what Fodor and Palmarini think are crucial problems raised for "Darwinism" by recent discoveries in molecular and developmental genetics. It turns out that the evolution of organismal form is constrained by an array of internal processes, ranging from the resilience of developmental mechanisms against both genetic mutations and environmental injury to the fact that genes act not as individual particles of heredity but as nonlinear extended networks characterized by several levels of feedback. This is all true, but the first property—known as *homeostasis* in biological parlance—has been well known since the 1950s, and no modern biologist would argue that internal con-

Massimo Pigliucci is professor of philosophy at the City University of New York–Lehman College, a fellow of the American Association for the Advancement of Science, and author of the forthcoming Nonsense on Stilts: How to Tell Science from Bunk. *His essays can be found at http://rationallyspeaking.org.*

straints do not limit what natural selection can do. Gene networks are a more recent discovery, and we are still trying to wrap our minds (and adapt our theoretical models) around the findings of twenty-first century molecular biology. But what Fodor and Palmarini astonishingly miss is that nonlinear feedbacks make the work of natural selection *easier*, not impossible, by leading to the self-emergence of complex structures that selection can then filter in proportion to their adaptedness.

When the authors gloat about "the return of the laws of form," referring to the century-old idea that internal mechanisms can explain a significant amount of biological complexity, they do not seem to understand that emergence allows us to solve the old conundrum "How is it possible for natural selection to produce complex structures by a number of infinitesimal variations?" The answer is that it doesn't have to because a significant amount of complexity is obtained as a byproduct of the biophysical properties of biological materials. For instance, genes do not need to specify the exact location and connections of every cell in the brain (there are trillions) because cells find their way during development by sensing the physical-chemical environment in which they find themselves.

What about the alleged philosophical problems with the theory of evolution? Here again Fodor and Palmarini identify an interesting question and then inexplicably veer in the direction of an absurd conclusion. The problem is that it is often difficult to distinguish between organismal traits that are being selected for (because they are advantageous) and traits that simply go along with the evolutionary ride (because they are inextricably genetically or developmentally linked with those under selection). This is a well-known problem in biology that illustrates the epistemic limits of historical science—after all, we rarely have access to sufficient information to definitely pinpoint one adaptive scenario over several possible alternatives. But Fodor and Palmarini twist this well-understood problem (about which more savvy philosophers of science like Carol Cleland have written extensively) into the bizarre conclusion that because there are no physics-like laws in biology, the entire enterprise can be reduced to storytelling.

It's not just that *What Darwin Got Wrong* has already begun to play (in an admittedly unintended fashion) into the hands of creationists and other evolution deniers. That crowd can quote Darwin himself in their apparent favor because they have no intellectual integrity. But it is sad to see otherwise serious philosophers and scientists jumping on the anti-Darwinian bandwagon in such a facile way. This is not going to help bridge Snow's divide between the two cultures, and in the long run it will make fools of those who have been so lackadaisical about such an important issue. □

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Entities—Who You Gonna Call?

Are you troubled by visions of things that go bump in the night? Are you visited by entities such as ghosts, aliens, angels, etc.? Who you gonna call? Why, the Department of Psychology at the University of Arizona, that's who. In 2002 Gary E. Schwartz, Professor of Psychology, Medicine, Neurology, Psychiatry, and Surgery at the University of Arizona, wrote *The Afterlife Experiments: Breakthrough Scientific Evidence of Life After Death*, which boasted a foreword by the celebrated Deepak Chopra. In it, Schwartz and collaborator William L. Simon described how they tested mediums and other sitters, who they claim presented evidence that proves the survival of consciousness after death. Their tests were critiqued by the noted psychologist and skeptic Ray Hyman in "How Not to Test Mediums" (see SI, January/February 2003). Hyman charged Schwartz with "inadequate precautions against fraud and sensory leakage," "failure to use double-blind procedures," and "creating non-falsifiable outcomes by reinterpreting failures as successes," among other failings.

Robert Sheaffer's "Psychic Vibrations" column has appeared in the SKEPTICAL INQUIRER *for the past thirty years, and he is author of* UFO Sightings: The Evidence *(Prometheus 1998). His Web site is at www.debunker.com.*

Now Schwartz seems determined to boldly go where no academic psychologist has gone before. He is recruiting subjects at the University of Arizona for the Sophia Project, an "Entity Communications Study" (see http://lach.web.arizona.edu/sophia/index.htm). No longer satisfied with limiting his studies to mediums and spirits, the Sophia Project will "investigate the experiences of people who claim to channel or communicate with Deceased People, Spirit Guides, Angels, Other-Worldly Entities / Extraterrestrials, and / or a Universal Intelligence / God. The ultimate objective is to investigate if these communications can be validated under controlled conditions." (The key words here are "controlled conditions," which seem to have given Schwartz some difficulties in his previous efforts.) The Web site is careful to point out that "this project is made possible by the generous support of private individual donors," indicating that no taxpayer money goes into it and that donations from individuals are solicited.

Obviously, the Sophia Project is staking out a pretty wide territory. People who claim to talk to the dead are prime candidates for this study (John Edward and Allison DuBois were both former subjects of Schwartz's), as are New Age "channelers," UFO abductees and contactees, as well as most practitioners of charismatic religious sects. For Schwartz

to succeed in proving that someone is indeed talking with a deity, he would have to established solid proof of the existence of a god or gods, something that philosophers and theologians throughout the centuries have attempted in vain.

As for the method to be employed, that is stated rather directly: "*Phase I: Experiential Review / Personality Baseline.* In this phase, we will collect information about the experience of communicating with these entities from people who claim to be in contact with them on a regular basis. In addition, we will also have subjects complete standardized personality tests in order to correlate reported experiences with personality type." This will be followed by "*Phase II: Verification.* The specific methodology of Phase II of the study will need to be determined after the data collection and analysis in Phase I reaches a level conducive to hypothesis development." Translation: "We have no idea how to do this, but we'll figure out how to analyze the data after we see what data we collect."

If you want to be a subject, Schwartz has some questions for you (and no, this is not a joke):

Please tell us a little about yourself:

Do you practice entity communication professionally (Do you charge a fee for this service)?

If you answered YES to the previous question, then please tell us which best describes your profession (Please check all that apply):

Professional Angel Communicator ☐
Professional Channeler ☐
Professional Medium ☐
Professional Psychic ☐

What types of entities are you in contact with? Please check all that apply:

Deceased People ☐
Spirit Guides ☐
Angels ☐
Other-Worldly Entities / Extraterrestrials ☐
Universal Intelligence / God ☐

It looks like Schwartz is expecting a pretty high level of paranormal flummery among his test subjects. I doubt that he will be disappointed.

* * *

What is "exopolitics"? It is defined on www.exopolitics.org as "political implications of the extra-terrestrial presence." That Web site reports almost two million Web visitors and twenty-nine million separate page hits since January 2003. A Google search on that term returns 269,000 Web pages. Adherents have no doubts that extraterrestrials are visiting Earth and interacting with officials of our government and probably many others. "Information concerning extraterrestrial life and technology is kept secret from the general public, elected political representatives & even senior military officials."

The guru of exopolitics is one Michael Salla, who has a PhD in government from the University of Queensland, Australia. I have written about him several times before in this column. For example, in the July/August 2004 SKEPTICAL INQUIRER I reported on Salla's claims about a "stargate" of the extraterrestrials known as *Anunnaki*, which has been in the Middle East since the days of the Sumerians. In July/August 2005, I wrote about Salla's wild talk on the subject of Nazi flying saucers (see http://tinyurl.com/5g3glp). For the skeptic with a keen sense of humor, exopolitics is like the gift that just keeps on giving, and the wonder is why anyone should pay any attention to what Salla says. But pay attention they do, and two million individual Web visitors can't *all* be deluded, can they? (Well, maybe they can.)

Now Salla is claiming that "independent sources" are confirming "an ongoing set of face-to-face meetings between U.S. military officials and extraterrestrial life. The sources reveal that senior U.S. Navy officers have played a leading role in an inter-services working group responsible for the meetings, and that different extraterrestrial groups are allegedly involved" (see http://tinyurl.com/ydmu26x). Supposedly one of the alien groups is the "Reptilians," while another is "a silicon based life form dubbed 'the Conformers,'" while yet a third group is called "Ebens," from Zeta Reticuli, "but known colloquially as the Grays." Salla claims to have interviewed one source for this tale and confirmed that he is a current U.S. Naval officer. Another source, also anonymous, is related to the alleged disclosures about Project Serpo, supposedly an exchange program between Earthlings and Zeta Reticulans (see SI, March/April 2006). This does not inspire confidence.

If you'd enjoy yet more claims of Salla, see his article about how "President Kennedy's UFO involvement led to assassination order" (http://tinyurl.com/SallaJFK). According to Salla, "On November 12, 1963, President John F. Kennedy had reached broad agreement with Soviet Premier Nikita Khrushchev on joint space missions and sharing classified UFO files. This required both leaders instructing their respective UFO working groups to share information." However, Kennedy's CIA director, Allen Dulles, was allegedly a member of MJ-12, a supposed super-top-secret group devoted to keeping UFO secrets under wraps. As soon as Dulles learned of Kennedy's intentions to spill the UFO beans, a secret order for the president's assassination went out from MJ-12, and somehow Oswald ended up getting the job.

But if anyone is rivaling Salla in producing weird tales, it is his colleague in exopolitics, Alfred L. Webre, a lawyer and peace activist. Webre claims to have found two sources who "confirm the existence of U.S. government development of time travel technology" (see http://tinyurl.com/WebreTime).

The first "whistleblower" was Andrew D. Basiago, a Washington State trial lawyer and environmental scholar who claims to have worked in a secret DARPA program called Project Pegasus. Interviewed on the celebrated sensationalist radio show *Coast to Coast AM*, Basiago gave what he claimed to be the history of "U.S. time travel research and teleportation technology" from 1969 to 1972. He claimed to have been teleported from "Wood Ridge, NJ to Santa Fe, New Mexico, via a device derived from Tesla technology. A 'chasm' opens up in the fabric of time-space that is wrapped around the 'teleportees' as they are repositioned to a new location." He also claimed that "teleportation technology could be used for time travel," as well as the development of "chronovisors" that

allow "holographic recordings to be made of historically significant events."

Supposedly, "time travel technology enabled the U.S. to win the Cold War, as the government teleported military secrets into the future, to store for safekeeping." He also claimed that this technology "was also used to brief U.S. Presidents like Clinton, the Bushes, and Obama about their destinies, years before they became President." So apparently the outcomes of all recent presidential elections were known at least to their future winners years in advance.

But before you get too concerned about the implications of all this, take note that Basiago has also claimed to have discovered life on Mars by analyzing photos taken by NASA's Spirit rover. In just one photograph, Basiago claims to have found "humanoid beings with bulbous heads and spindly bodies, like the Gray 'extraterrestrials' of the UFO literature," as well as "human-insect hybrids, such as The Scorpion Man that can be seen in The Turquoise Field; Human-reptile hybrids, such as the Gumby Lizards that can be seen in and around The Rock Garden; and beings with humanoid heads and larval, worm-like, or slug-like bodies that can be seen throughout photograph PIA10214," and even "forms that are almost 'all head,' like the comedic form christened Mr. Potato Head, which might not be a life form but a building" (see http://tinyurl.com/BasiagoMars). Believe it if you can.

The second "whistleblower" was David Lewis Anderson, director of something called the Anderson Institute, who is said to have "laid the foundations for what would later become known as time-warped field theory, an approach that modeled and described how to use the natural forces of inertial frame dragging to create contained and controllable fields of closed-timelike curves." Wow! The Web site describes the Anderson Institute as "a premier high technology research institution, delivering scientific and engineering solutions for the most crucial and complex problems in spacetime physics. Our primary mission is the development of time-warped field theory, its application and ensuring the ongoing development of time reactor system design concepts and capabilities" (for more, see www.andersoninstitute.com/about-the-anderson-institute.html). So the next time I'm troubled by rips and tears in space-time, I'll know who to call. The Web site discusses "Time Control Technologies and Methods," including Quantum Tunneling, Near-Lightspeed Travel, Alcubierre Warp Drive, and Time-warped Fields. It's not clear exactly what they claim to *do* with all this woo-woo stuff, but Anderson claims to have been doing time-control research for the U.S. Air Force, which would be a scandal if true.

Webre suggests these developments are "secret time travel advancements by the U.S. government and private industry that may articulate a way out of the current depression via investment in a 21st century infrastructure that would include teleportation and other new energy applications." Well, if it's come to this, our economy is *really* in trouble. I'd rather stick to voodoo economics.

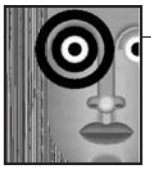
* * *

If religious broadcaster Harold Camping is correct, those who proclaim the world will end in December 2012 are too optimistic about the future. He sees the Rapture occurring on May 21, 2011 (see http://tinyurl.com/Rapture2011). Camping, eighty-eight—whose Family Radio broadcasts from Oakland, California, are carried on fifty-five radio stations in the U.S. and are translated into forty-eight foreign languages—says he has scrutinized the Bible for almost seventy years and developed a mathematical system to interpret prophecies hidden within it. He noticed that particular numbers appear in the Bible at the same time particular themes are discussed. This led him to conclude that certain themes are represented by certain numbers. For example, 5 represents "atonement," 10 is "completeness," and 17 represents "heaven." His predictive formula involves taking the date of Biblical events and adding to them numbers derived from these themes. (Just in case you were wondering, the Creation occurred in the year 11,013 BCE and the Flood in 4,990 BCE.) He found that the date of Jesus' crucifixion, to which is added (Atonement × Completeness × Heaven), squared and multiplied by the number of days in a solar year, gives us the year 2011! With a bit more tweaking we get May 21 of that year. Truly, I am speechless.

This is not the first time that Harold Camping has made a specific prediction for the End Times. He announced in 1992 that the date would be September 6, 1994.

Unfortunately, this is not the first time that Camping has made a specific prediction for the End Times. He announced in 1992 that the date would be September 6, 1994. On that date, several dozen of Camping's followers, Bibles in hand, gathered in a hall in Alameda, California, to await the Rapture.

So if Camping is correct, we will have nothing to worry about in December 2012 because the world will already have ended a year and a half before that. □

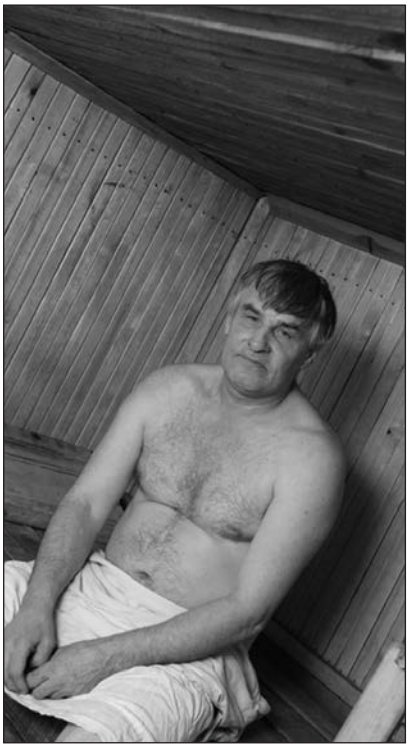


Sweating the Small Stuff

Q: I heard about the recent sweat lodge deaths at the seminar by guru James Arthur Ray. When I get spa treatments, the technicians tell me I can sweat out my body's toxins with a steam bath or heat wrap. Is that the idea behind a sweat lodge?

—P. Melquist

A: On February 3, New Age motivational speaker James Arthur Ray was charged with three counts of manslaughter for his actions during an October 8 sweat lodge ceremony he held near Sedona, Arizona. Three people died, eighteen were hospitalized, and more fell sick. After an hour inside the small, steam-filled tent, some participants collapsed and others began vomiting. Ray encouraged them to stay and endure the discomfort as a form of cleansing that would make them stronger. The cause of the deaths has not been determined, but it is well known that exposure to the conditions present in the sweat lodge can lead to heat stroke, dehydration, smoke inhalation, or suffocation. (For more on this, see Martin Gardner's "James Arthur Ray: New Age Guru and Sweat Lodge Culprit," SI, March/April 2010.)



Sweat lodges in various forms have been around for millennia. The purification many people seek from them is partly physical and partly spiritual. The sweat lodges most New Agers are familiar with (and which Ray used) are loosely modeled on those used by Native American tribes. The high heat, steam, and New Agey social fervor could have led some participants to have a spiritual awakening (if not hallucinations), but there's no evidence that they do anything else.

The idea that the body can sweat out toxins is widely believed. Hot springs and pricey spas around the world offer sweat wraps and sweat lodges, promising to detoxify and purify the body. Steam rooms can be warm and relaxing, but there is no scientific proof that people can "sweat out" toxins or impurities from the body.

Sweating is the body's method of regulating its temperature. Because humans are warm-blooded, our bodies need to control excess heat (generated either internally, as in a fever, or externally, as on a hot summer day). When the body gets too hot, it releases water via sweat glands, which in turn cools the skin and body through evaporation.

Organs such as the liver help the body collect and get rid of toxins, but sweat glands do not. Sweat, which is mostly water with some dissolved minerals and urea, is nontoxic; therefore, the idea of "sweating out the toxins" is simply wrong. Sweating will make you cooler but won't cleanse or purify your body. Human physiology simply does not work that way. A steam bath or sweat wrap can be relaxing, but it is no more "cleansing" than a hot bath—which is far safer than a sweat lodge.□

The Amazing Ardi

Image: PRNewsFoto/Impossible

As part of the "Discovering Ardi" documentary (which premiered on the Discovery Channel October 11, 2009), about one of the greatest discoveries in human evolution, Impossible, a Colorado design and visual effects studio, created sophisticated animations to bring Ardi to life.

She awoke to the cacophony of brightly colored birds and the scent of flesh. Something had died or been killed during the night. She leapt into a tree and, on all fours, deftly palmed her way over a sturdy branch. As she peered downward through the fluttering leaves, she spotted the male who had fathered her last two offspring. He crouched over a small carcass. She squeaked hopefully and then demandingly as his hungry gaze rose and softened. She descended the tree as he stood upright and watched for others. The male then lumbered a few steps away and turned, offering her what was left of the meat. She sniffed the air greedily, ambling toward it on two legs. Unable to contain herself, she finally screamed in delight as she snatched her prize back into the tree.

In December, *Science* dubbed her "breakthrough of the year." *Discover* ranked her third among the top one hundred world-changing discoveries of 2009. *Science News* called her a "biker chick" and the "ultimate evolutionary party crasher." Whatever the weighty homage, a truly amazing fossil has turned paleoanthropology on its crusty ear.

Let's start with the essential facts and figures: First unearthed beginning in 1992, *Ardipithecus ramidus* and its ancient environment were finally dissected for the world in eleven research articles and authors' summaries in the October 2, 2009, issue of *Science* magazine in print and online. Seventy investigators of the international Middle Awash Project—forty-seven of whom became authors—found 135,000 vertebrate pieces and 110 *Ar. ramidus* specimens comprising at least thirty-six individuals in Ethiopian sediments dated to 4.4 million years old.

"Ardi," the species' impish prima donna, is now the most famous and informative fossil hominin since Lucy (*Australopithecus afarensis*), who in 1974 clocked in at about 3.2 million years old. Evidenced by a fairly complete 125-piece skeleton, Ardi stood 1.2 meters (4 feet) tall and weighed about 50 kilograms (110 pounds). Her brain measured only 300 to 350 cubic centimeters in volume—about the same as that of a female chimp.

So why all the fuss? According to Tim "The General" White, lead author and

Kenneth W. Krause is a contributing editor and science news columnist for the Skeptical Inquirer *and a contributing editor and books editor/columnist for the* Humanist. *He has published frequently in* Skeptic *and* Wisconsin Lawyer *as well. He may be contacted at krausekc@msn.com.*

project co-director from the University of California at Berkeley, Ardi's anatomy offers profound surprises that "no one could have imagined" absent this new evidence. *Ar. ramidus* also "nullifies" our old, chimpanzee-centric model of hominin origins, adds Kent State University's C. Owen Lovejoy, and therefore threatens to overturn certain basic assumptions about early human evolution.

The last common ancestor of both chimps (*Pan troglodytes*) and hominins lived from between five and eight million years ago, depending on whether one emphasizes DNA studies or fossil evidence. Possessing few informative examples of early ape evolution, scientists since Darwin's time have characterized the ancestor as a sort of prototroglodyte, with arms adapted for swinging and pelvises and limbs for knuckle walking. The prevailing assumption, in other words, was that humans had done practically all of the evolving since the *Pan*-hominin split.

The experts have also remained frustratingly vexed by our momentous transition to bipedalism. By the time of Lucy, the hominin pelvis had already developed the essential adaptations for upright walking. Again, the fossil record of earlier human pelvic evolution was scant and mostly uninformative. Nevertheless, anthropologists have long hypothesized that bipedalism was specifically adapted to the savannas and open grasslands occupied by Lucy's kind and its successors.

But Ardi's amazing features seem to tell a different story, as do the project's collection of more than 150,000 fossilized plant and animal specimens contemporary to *Ar. ramidus*.

If the last common ancestor didn't look like an ape, as conventional wisdom maintains it did, then chimps, bonobos, and gorillas must have developed their many similarities independently. This is exceedingly difficult for many scientists to believe. Even so, relative to chimps, Ardi had a short lower muzzle and cranial base, consistent with those of more recent bipeds. And her canines—along with those of her male counterparts—were smaller and less sharpened, or honed, possibly evidencing the adoption among early hominins of less aggressive and more cooperative social and reproductive strategies well prior to the development of enlarged brains and tool use. But more on that later.

Ardipithecus ramidus also "nullifies" our old, chimpanzee-centric model of hominin origins, and therefore threatens to overturn certain basic assumptions about early human evolution.

Although she retained an ape-like opposable big toe—useful for an arboreal, quadrupedal style of grasping movement over branches called *palmigrady*—Ardi's remaining toes were more rigid than those of chimpanzees. And the upper blades of her pelvis were broader as well, more akin to Lucy's. Such distinctions, say the authors, would have allowed Ardi to balance on one leg and push off with her back foot. Thus, they infer, *Ar. ramidus* could actually walk upright on the ground—though much more primitively than *Au. afarensis*—as a so-called "facultative" biped.

But Ardi didn't walk on the savannas or open grasslands, which apparently didn't even exist in her time and place. According to White, *Ar. ramidus* inhabited a relatively cool and humid woodland analogous to the Kibwezi Forest in present-day Kenya. Among the fossilized remains, the team found no evidence of a humid, closed-canopy tropical rainforest or of sub-desert vegetation typical of the region today. Instead, they discovered wood, seeds, and other plant materials indicating the prevalence of hackberry, fig, and palm trees. They also recovered more than six thousand vertebrate species, including many small mammals and birds that were highly sensitive to their environment and thus extremely helpful in its reconstruction.

One might therefore reasonably speculate that Ardi fed more omnivorously than her hyperspecialized ape cousins. The team measured the enamel in more than thirty *Ar. ramidus* teeth and compared it to those of chimpanzees and later hominins. The enamel in Ardi's molars, they found, was of intermediate thickness—not so thin as in chimps, which eat soft, ripe, arboreal fruits, but not so thick as in *Au. afarensis* or later *Homo*, who consumed more abrasive, terrestrial plants. In the end, the researchers did indeed surmise that Ardi had dined on everything from fruits, nuts, and tubers to insects, small mammals, and bird eggs.

In the Afar tongue, *Ardipithecus ramidus* refers to a ground-living ape near the root of the family tree. As one might expect, paleoanthropologists aren't usually shy about claiming the exalted human ancestor status of their particular specimens. And although White stops short of insisting that his fossils are necessarily ancestral to the Australopithecines—generally accepted as the evolutionary precursors to *Homo*—his team is quick to emphasize those features that appear to mark Ardi's kind as a transitional group between the six- to seven-million-year-old Toumai (*Sahelanthropus tchadensis*) and Lucy.

Gen Suwa from the University of Tokyo, for example, writes that despite the diminutive size of Ardi's skull, "the brain of *Ar. ramidus* may have already begun to develop some aspects of later hominid-like form and function."

Toumai, Ardi, and Lucy shared short cranial bases and skulls that were downturned at the rear. Again, these features tend to identify them as upright walking hominins rather than apes. Suwa reasons further that the base of Ardi's brain may have been more "flexed" than those of apes, a trait that occurred in *Australopithecus* along with enlargement of the posterior parietal cortex. In modern humans, this brain region is key to visual and spatial perception.

But Lovejoy envisages an even more profound evolutionary implication in *Ar. ramidus*. Noting that certain signature human specializations—dentition, locomotion, and encephalization, in particular—are closely related to our reproductive anatomy, Lovejoy suggests that in light of Ardi we can no longer assume that these unique characteristics emerged piecemeal and only since the dawn of the Pleistocene. Rather, he contemplates an interconnected "adaptive suite" of both physiological and behavioral traits that evolved well prior to the age of the Australopithecines "within a unique reproductive strategy that allowed early homini[n]s to thrive relative to their ape relatives and could have ultimately accommodated rapid development of the unusually energy-thirst[y] brain . . . in *Homo*."

Back in 1981, Lovejoy proposed a hominin sexual revolution manifest in *Au. afarensis*. In most ape species, comparatively large males battle furiously against one another for access to smaller females who openly advertise their sexual receptivity. Not surprisingly, female apes raise youngsters on their own. But the anatomy of Lucy's kind was quite different; bipedal males were only slightly larger than females and bore small, relatively innocuous canines. From this evidence, Lovejoy inferred that female Australopithecines—which did not advertise their sexual availability—had begun to select more fatherly, monogamous mates that regularly carried food to the mothers of their offspring. Most experts disagreed with the author's vision of a kinder, gentler ancestor back in 1981, much as they do now.

But Lovejoy remains convinced. Indeed, he now argues that the sexual revolution occurred well before Lucy's time, even prior to *Ar. ramidus*. "The evidence is now conclusive," he declares. Contrary to long-standing wisdom, the loss of large, honed canines among hominins happened well before they abandoned arboreal habitats and began using tools. "It is far more likely," he vies, "that our unique reproductive behavior and anatomy emerged in concert with habituation to bipedality and elimination of the [sectorial canine complex]." He summarizes: The ability of Ardi's kind to exploit both trees and land and to reduce male-to-male conflict merged with "three previously unseen behaviors"—regular food carrying, ovulatory crypsis, and pair bonding—to intensify parental investment among males.

Lovejoy's hypothesis certainly offers an intriguing explanation of why humans developed advanced cognition while chimpanzees, for example, did not. But, unsurprisingly, many of the project's conclusions have met with tough, even harsh, criticism. George Washington University anthropologist Brian Richmond emphasizes the folly of conceptualizing the last common ancestor without ever having viewed its fossils. Carol Ward, a specialist in integrative anatomy at the University of Missouri–Columbia, thinks that Ardi's knees might have been spaced too widely for efficient walking. And Cambridge University anthropologist William McGrew claims that in fact there was a sufficient size distinction between *Ar. ramidus* males and females to indicate heightened male aggression and promiscuity.

I asked William Jungers, anatomist at Stony Brook University in New York, what he thought of the project's findings. Although eager to examine the fossils and casts himself before reaching any final conclusions, he calls the existing evidence for Ardi's bipedality "exceedingly weak (and perhaps nonexistent)," stressing that, technically, chimpanzees qualify as "facultative bipeds" too. He was even less deferential to Lovejoy's sexual revolution hypothesis, dubbing it a "warmed-over theory of everything." But Jungers reserves judgment as to just how closely Ardi represents the last common ancestor between hominins and *Pan*. That conclusion, he says, "awaits a formal, character-based analysis" any number of which should be forthcoming.

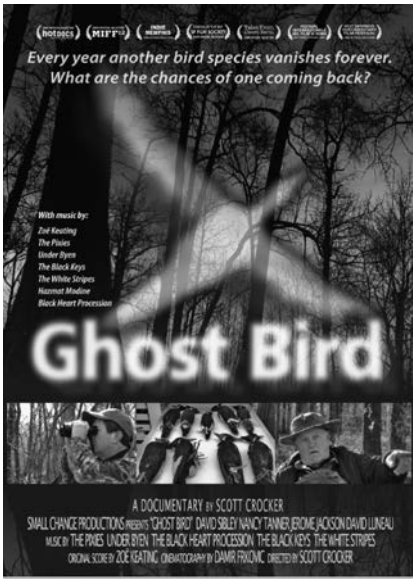
The project's inspiring results were worth the wait. The amazing Ardi has challenged and defied anthropologists like no fossil hominin ever has.

But everyone seems to agree that White's team members should be applauded for their meticulous efforts and exhaustive treatment of these critical subjects. Yes, we've been looking forward to *Ar. ramidus* for a very long time—more than fifteen years now. But the project's inspiring results were worth the wait. The amazing Ardi has challenged and defied anthropologists like no fossil hominin ever has. Because of her, those who crave a deeper understanding of human origins have much to contemplate and, better yet, a plethora of groundbreaking science to look forward to in the very near future. □

Chasing the Ghost Bird: Science, Skepticism, and the Ivory-billed Woodpecker

Interview with Scott Crocker

BENJAMIN RADFORD


Every year another bird species vanishes forever.
What are the chances of one coming back?
Ghost Bird
A DOCUMENTARY BY SCOTT CROCKER

The chance sighting in Arkansas's Cache River National Wildlife Refuge of a presumed extinct woodpecker led to a 2005 scientific expedition that confirmed that the birds still live. The ivory-billed woodpecker (*Campephilus principalis*), last known to exist in 1944, was supposedly sighted in eastern Arkansas in 2004. A blurry video clip showed the bird's distinctive size and markings. "The bird captured on video is clearly an ivory-billed woodpecker. Amazingly, America may have another chance to protect the future of this spectacular bird and the awesome forests in which it lives," said John Fitzpatrick, director of the Cornell Laboratory of Ornithology.

The discovery of the bird spawned international headlines and an article in the journal *Science* (see "Rare Woodpecker, Presumed Extinct, Found in Arkansas," SI, March/April 2006). The rediscovery was also trumpeted by believers in Bigfoot and lake monsters as proof that animals thought long extinct may still exist.

Yet after five years of searching (at a cost of over $10 million) the ivory-billed woodpecker's existence remains unproven. Not a single bird has been found. A discovery once touted worldwide as a hopeful environmental miracle has turned into a complex and fascinating tale of environmentalism, anecdotal evidence, and scientific debate. What happened is the subject of a new documentary film titled *Ghost Bird*. I interviewed the film's director, Scott Crocker.

BENJAMIN RADFORD: *Why was the story of the rediscovery of an obscure woodpecker such a big deal?*

SCOTT CROCKER: Strangely enough, the ivory-bill has captured the imagination of people the world over for a very long time. They were truly striking black and white woodpeckers, the males having bright red crests, and they were once the largest woodpeckers in North America. Full grown they were two feet tall and had a wingspan of nearly three feet.

The alleged rediscovery of the ivory-billed woodpecker in 2005 made headlines around the world. That a species of this magnitude had returned from the dead after being presumed extinct for over half a century was both miraculous and astonishing. A kayaker's sighting was confirmed by a search team from Cornell University's Laboratory of Ornithology, one of the world's leading institutions devoted to studying all things avian. Their rediscovery in Arkansas was perceived as a kind of environmental miracle suggesting that mankind was getting a second chance to save a species he had singlehandedly exterminated. And just maybe, the efforts of conservationists were beginning to turn the tide of human-caused extinctions.

RADFORD: *The tiny town of Brinkley, Arkansas, was the epicenter of the furor over the ivory-bill. What effect did all this international publicity have on the town?*

Scott Crocker, director of *Ghost Bird*.

A collection of ivory-billed woodpeckers at Yale University's Department of Ornithology

CROCKER: Brinkley played a central role in both receiving and reinforcing the rediscovery hype, partly because they had nothing to lose.

RADFORD: *Many towns that have a local "monster" are quick to capitalize on their local mystery (for example, Bluff Creek, California, has a booming Bigfoot-related business, and Inverness, Scotland, earns a lot of money from Nessie tourism). Brinkley, quite understandably, did the same thing.*

CROCKER: They tried. While some locals were quick to capitalize on the publicity by selling ivory-bill burgers, haircuts, and T-shirts, the influx of birders and their fat wallets never quite materialized. The world's only ivory-billed woodpecker gift shop has closed, and there was only one Annual Ivory-bill Celebration in Brinkley's new convention center.

RADFORD: *How did you get involved in making* Ghost Bird?

CROCKER: I heard about the ivory-bill's rediscovery like everyone else, when then-Secretary of the Interior Gale Norton announced it had been seen in Arkansas. And as fascinating as the rediscovery was, I was equally intrigued by the descriptions of the yearlong top-secret search and the many hours birders spent deep in the snake- and mosquito-infested cypress swamps of Arkansas waiting for a glimpse of the largest and rarest woodpecker in North America. It sounded like a Samuel Becket play, *Waiting for a Woodpecker*.

I didn't get personally pulled into the story until the following September. I was attending the Jackson Hole Wildlife Film Festival where I met a cameraman who had practically lived in those swamps waiting for the ultimate money shot. Fourteen months later he emerged with a couple brief sightings and a few compelling bird sounds only to discover his second wife had left him. I thought, wow, these people are seriously obsessed. I needed to find out why. While I didn't go into it as a skeptic, I also didn't unquestioningly accept everything the search team announced or claimed about their very blurry video of something flying through the swamp.

RADFORD: *One person in your film described the debate as about "hope versus skepticism."*

CROCKER: That was [bird expert] David Sibley's distillation of the whole issue, and I think he hit the nail on the head. The sightings by top ornithologists, their scientific documentation, and the controlled media campaign announcing the ivory-bill's rediscovery created an atmosphere that was not unlike G.W. Bush's doctrine

of "Either you are with us or you are against us."

RADFORD: *That doesn't sound like open, scientific debate.*

CROCKER: Well, some of that exclusiveness came down to the good intentions of protecting the species from being "loved to death" by birders. However, it was also driven by the need to raise money and acquire local land inexpensively. Questioning the evidence was a threat to the $10 million in federal, state, and private money the search team raised. Questioning the sightings also meant questioning the integrity of the ornithologists and birders who made those sightings—and the birding community heavily relies on individual integrity. Since the search scientists didn't invite any real critique of their findings, in the end you were either on board and hopeful, or you were a skeptical outsider. And no one wanted this iconic bird's rediscovery not to be true.

RADFORD: *Political grandstanding and bird expert squabbles aside, the ivory-bill's rediscovery was given scientific credibility by a high-profile cover article in* Science*, right?*

CROCKER: Absolutely. The *Science* article in many ways is the lynchpin to all of this. Without that article and the magazine's enormous clout, I don't think the rediscovery would have had much traction. That their editorial staff seemingly looked the other way and gave the ornithologists the benefit of the doubt raises some of the more interesting questions about the whole rediscovery fiasco. How much of this had to do with selling magazine issues? How much had to do with everyone hitching a ride on a career-making moment?

RADFORD: *What does the story of the woodpecker say about how science works?*

CROCKER: I think the most disturbing message of the rediscovery is the central role money plays in driving scientific inquiry and research. One academic who has been tracking this trend described to me the process of acquiring funding for research as being akin to throwing spaghetti at the wall: whatever project sticks gets the green light. This "stickiness factor" of proposals is often determined by very unscientific agendas having more to do with commercial and public relation interests.

RADFORD: *How did the search for the ivory-bill become so politicized, with agendas and egos?*

CROCKER: Territorial squabbles are of course nothing new to academics. And there was a healthy amount of slinging from both sides in the ivory-bill debate. However, the real anger surrounded the redirection of scarce funding from existing endangered species recovery programs to the search for a ghost bird. It's one thing to run around in the swamp seeing things. It's another thing entirely to do that with money "rediscovered" in the research accounts of other scientists. This brings us back to the legacy of the Bush administration: they promised $10 million in funding for the search but then robbed Peter to pay Paul; it wasn't new funding.

RADFORD: *What's been the response to your film? Is there any current funding for the search, or is it effectively dead?*

CROCKER: Cornell continues to maintain that they saw an ivory-bill and documented it on video. They admit that the bird has not been quite as "persistent" as they had hoped. As of this year they are no longer actively searching for the bird in Arkansas, though they were one of two groups looking in Florida last year.

RADFORD: *Does it matter if the ivory-billed woodpecker exists or not?*

CROCKER: If there's only one of them, no, not really. I think what matters is that we collectively come to grips with taking responsibility for the species mankind is causing to go extinct. Ultimately, perhaps the most lasting significance of the ivory-bill is how it has become a mirror that reflects back to us our difficult relationship to the natural world and our uncertain place in it. We can look deeper into that mirror and change how we inhabit the planet, or we can look away and go about our business as usual.

"One academic who has been tracking this trend described to me the process of acquiring funding for research as being akin to throwing spaghetti at the wall: whatever project sticks gets the green light."
—Scott Crocker

Ghost Bird opened in New York City at the end of March for a week at Anthology Film Archives. The DVD should be available in June; find more details at www.GhostBirdMovie.com.

Benjamin Radford is managing editor of the SKEPTICAL INQUIRER and an avid fan of documentary films.

Brain Science, God Science

Why Religion Endures

Suppose there is no god. It wouldn't matter. A god or some equivalent is a product of the normal human brain. It is almost a neurological secretion.

MICHAEL MCGUIRE and LIONEL TIGER

Let's suppose that it could be shown scientifically and to universal satisfaction that there is no god, no afterlife, no heaven, no hell, no conflicted James Joyce, no grand design of the universe, no intelligent design, no Adam and Eve, no anything but nothing after death. What then?

Would atheists disappear? Would agnostics acknowledge that they had seen the light and confess that they always basically knew the idea of a god was a stretch? Would believers jettison their religions and beliefs and embrace those who had shown that there was nothing more for humans than their brief experience here on Earth? Would prayer meetings and revivals disappear? Would churches empty? Would they lose tax exemptions for their buildings? Would religion's literature and artifact businesses file for Chapter 11?

There are answers to these questions. Some are obvious. For example, atheists would not disappear but surely increase in number, as they have over decades. A percentage of agnostics would announce their conversion to atheism. But what of the vast majority of that 80 percent of the world's population that claims some relatively active affiliation with a religion? Would they live with the facts that have after all been available to them for years? Would they graciously accept that there is nothing more to life than what they experience here on Earth?

We doubt it. In fact, we strongly assert that religion and belief in a god would thrive irrespective of the presence of solid evidence refuting them.

Why? The answer is simple: a god or some equivalent is a product of the normal human brain. It is almost a neurological secretion. And there is no reason to suspect that the brain is going to change in any significant way in the foreseeable future.

The road to this answer began well back in time, perhaps 150,000 to 200,000 years ago. This was a time in which the brains of our ancestors were changing and their exodus from central Africa was about to begin. It was a period in which the capacity to imagine events and things one had not experienced was likely to have developed. Could there be better places to live, more game to hunt, available water for most of the year, and fewer dangerous predators? Life was difficult and uncertain, and a more benign environment was worth a thought. Such imaginings were likely a key factor in the exodus that, over the next 100,000+ years, led to our species occupying literally all of the lands of the world except North and South America.

Imaginings don't discriminate. Just as desirable things can be imagined, undesirable ones can too, even unlikely undesirable things. And at times such imaginings were advantageous. Imagining that there was a dangerous predator lurking behind every bush and taking appropriate precautions probably saved countless lives.

It's likely there were also other types of imaginings, such as those about hell. No newspapers, books, discoveries in caves, radio and TV programs, distinguished lectures, historical artifacts, or Internet communications announced and documented this idea. They were evidently not necessary. Humans imagined it. And no newspapers or other announcers asserted that there might be nothing after death. Humans imagined it.

But this is only part of the story. Humans in that distant past we are discussing also developed a strong aversion to uncertainty and ambiguity. People past and present like to be certain that there will be a meal for dinner and a bed for the night. These are part of their real, everyday world, which they have learned how to manage successfully most of the time. But they also like to be certain about those things they imagine that are not part of their real, everyday world. For example, they search for an antidote to the malady of nothingness.

Enter the idea of an afterlife. Pause for a moment and consider the brilliance—Nobel Prize brilliance—of the original idea. It ranks with the genius of Copernicus, Galileo, Kepler, Newton, and Einstein. Suddenly, unexpectedly, vividly, and spontaneously, there was a solution to nothingness. Ambiguity and uncertainty could be resolved. All that was required was belief that—it would turn out—stimulated specific behaviors that affirmed consent to that belief and to the communities that sustained it. And all this was presumably accomplished in a somewhat agreeable way; otherwise, why would anyone bother?

Michael McGuire is president of the Biomedical Research Foundation and director of the Bradshaw Foundation and the Gruter Institute of Law and Behavior. Formerly, he was a professor of psychiatry and biobehavioral sciences at the University of California at Los Angeles and editor of Ethology and Sociobiology. *He was the first to identify the sociogenic impact of serotonin and behavior. He is the author or editor of ten books, including* Darwinian Psychiatry *(with A. Troisi).*

Lionel Tiger is the Charles Darwin Professor of Anthropology at Rutgers University. He is the bestselling author of Men in Groups, The Imperial Animal *(with Robin Fox),* The Pursuit of Pleasure, Optimism: The Biology of Hope, *and* The Decline of Males. *His articles have appeared in* The New York Times, The Wall Street Journal, Rolling Stone, Harvard Business Review, *and* Brain and Behavioral Science. *Tiger and McGuire are coauthors of* God's Brain, *published in March 2010 by Prometheus Books.*

Evolution continued. Humans came to create and find comfort in organizations and rules that promise predictable and desirable outcomes. But not unexpectedly, once the idea of an afterlife emerged from the human imagination, there were disagreements about its nature and what might be necessary to assure that it was available to everyone.

Enter religion. This is the regulatory body that manages the steps, thoughts, procedures, rules, beliefs, and personal sacrifices essential to assure that life continues following medical-legal death. These, too, were products of the human imagination.

In the absence of any coercively concrete evidence, humans were free to organize themselves in ways that led to predictable and desirable outcomes.

What a brilliant solution, even if it is circular! First imagine hell and nothingness. Then experience the ambiguity and uncertainty they provoke. And then develop a nondisprovable system that resolves these vexing thoughts and feelings. Get a clubhouse in which to enjoy the whole thing. Bingo.

The human brain has evolved to act, not to think. And in its need to develop a solution to the uncertainties of death, it acted to concoct something potent enough to make men go to war, powerful enough to make sense of every miserly experience and offer reasons and explanations for all the whys of life on Earth.

Archaeological data consistent with evidence of a sense of a god or higher order and an afterlife date back approximately 70,000 years. No doubt the evidence available is not from the first moment of such thoughts. Therefore the 70,000 could conceivably be doubled to 140,000 to obtain a rough estimate of when imaginings about an afterlife were codified and when procedures and rituals associated with assuring its attainment first evolved.

This was about the time that dispersion of *Homo sapiens* out of Africa began, which may in part explain the multiplicity of religions across the world. Over time, groups developed in different climates and geographies and with different histories. They produced their own locally relevant versions of an afterlife and the requirements to assure it. Why else would the Lord be our shepherd—though never in an Arctic community?

Then of course there was this tricky variable: human nature. Humans differed in their capacities, beliefs, and behavioral prescriptions then just as they do now. This assured that stable organizations wouldn't develop overnight, and they would certainly not be all the same. Through all of this humans continued to imagine, make up stories in their heads, paint on cave walls, and maybe sing songs. If one picks up their story at about the time of recorded history, it is clear that there were literally hundreds of bewilderingly different gods, manners of worship and devotion, and rules for conforming to the expectations of the managers residing in the heavens who oversaw those on Earth.

Before Christianity and Islam, centuries of discussion, debate, and conflict preceded the development of organizations and structures that could weather the next winter. It is vital to understand that the major religions of the world developed in the transition from hunting-gathering to agriculture and pastoralism. Before then, food gathering was retail—one deer at a time. But suddenly one ear of corn produced 180 seeds, and two goats could generate hundreds over a few moons. This produced serious challenges for fair distribution of resources. It's what gave us "The Lord is my shepherd."

This, in short, is a possible scenario for how imaginings about an afterlife and religions as organizations might have begun. But if this is all that they did and do, it seems unlikely that religions would have come to exert the influence over human thought and behavior that they have in the recorded past and still do today.

This takes us to a second part of the story: stress and how people deal with it.

A quick summary: socialization associated with participating in religious activities has an effect in normalizing brain chemicals and offsetting stress.

Like it or not, life is full of stress. Perhaps many people will be surprised to learn that the most frequent causes of stress are seldom due to life's milestones, such as the birth of a child, graduation from college, marriage, or one's fiftieth birthday. Usually these events occur years apart. They are anticipated. There is advanced planning and preparation. There is helpful lore about them. Rituals are in place. People help out. Stress is part of their design. And a sense of accomplishment when they're done is a durable reward.

It's another type of stress we are discussing. A flat tire when one is late for a meeting, the unexpected loss of one's job, a significant drop in the stock or housing market, a speeding ticket, a leak in the roof, an unfaithful spouse, and so forth.

Life is full of stressful and aversive moments. Up to a point most humans are adept at tolerating them. But there is a threshold for each individual, and when the threshold is reached the body and brain begin to change chemically. Different juices flow.

The standard physiological measure of stress is the brain level of cortisol, a chemical secreted by the adrenal cortex when it is stimulated by ACTH (adrenocorticotropic hormone). This mediates various metabolic processes. It has anti-inflammatory and immunosuppressive properties. The somatic effects of these changes are unpleasant. Difficulty concentrating, emotional instability, hypertension, apprehension, fatigue, and lack of direction and purpose are common symptoms.

But cortisol is only the beginning. Other body chemicals, in particular serotonin, dopamine, norepinephrine, and oxytocin are also involved. They too respond to stress.

Most people have devised ways of reducing their stress: take a vacation, have a drink, visit a spa, watch a movie, exercise,

sleep, and so forth. And these remedies often work. The amount of alcohol drunk, the success of spas and movies, and the number of people who exercise regularly provide a rough measure of the amount of stress people experience.

Enter religion again, this time in a very practical and therapeutic way. We have already mentioned the stress-reducing effects of believing that decrease ambiguity and uncertainty, resolve the nothingness void, and provide some continuity between life on Earth and events following death.

But religions have two other features that predictably and successfully relieve stress: socialization and rituals.

The reduction in stress that results from religious socialization works in a rather simple way. Believers gather at a location they consider sacred where special rules of behavior apply. They see familiar and unfamiliar faces, but usually far more of the former. Even the new faces carry possible commitment to the common group and hence a better, more populous future. Familiar faces and their emotional expressions are reassuring and invite good thoughts. The ambiguity and uncertainty that often accompany encounters with unfamiliar persons are largely gone. So are the uneasiness and hesitancy that can permeate moments in which the majority of faces are unfamiliar and their signals mixed and unclear. What a contrast to daily life! How simple but significant a change in state.

The brain and its chemicals predictably respond to such moments. Among the main chemical players are serotonin, dopamine, and norepinephrine. These are all neurotransmitters—molecules involved in transmitting messages between neurons. And then there is oxytocin, which is both a hormone and a kind of neurotransmitter. When they are within normal ranges, people feel healthy, think clearly, are not frightened, and are trusting. When they are outside normal ranges, as they are during stressful events, the opposite occurs.

Positive socialization—friendly smiles, sincere greetings, hugs, and the like—increases brain levels of serotonin. This leads to relaxation, less quarrelsome behavior, emotional stability, and feelings of decent personal status. The same is true with norepinephrine, which also increases during periods of socialization. Dopamine also increases, but it has a different effect in that it is associated with expectations of reward. The rewards that follow from friendly smiles, sincere greetings, and hugs deal with an individual's place in a group. He senses that he is a member (an important member), that other people find him desirable, that he has status, and that he may be meaningful to them. In short, positive socialization "normalizes" abnormal brain chemicals in positive and predictable ways. What happens externally has direct internal impact.

Oxytocin is a slightly different matter. Increases in levels of oxytocin follow after receiving positive social signals. One's sense of trust toward others, particularly those who send positive social signals, increases.

A quick summary: socialization associated with participating in religious activities contributes to normalizing brain chemicals and offsetting stress. Rather firmly, it leads to positive feelings about oneself and the members of one's group.

Ritual is the third feature of religion. There is nothing unfamiliar about rituals, of course, by definition. They are everywhere, every day, every moment: what time school starts, when and how to salute the flag, who sits down first at the dinner table, how one manages a four-way stop-sign intersection, where one stands in line at the grocery store or a in movie queue, how one is seated at weddings, etc.

To be efficient and likely to endure, rituals must accommodate a suite of human predispositions that have a genetic basis. This seems to have happened with literally every major religion. For example, in Judaism, Islam, and Hinduism virtually every important milestone from birth to death—maturation points, marriage, bearing offspring, attaining official membership—is ritualized. So are the details of religious conduct. Praying, singing, chanting, moments of silence, who leads in processions, how sacred texts are placed and held, and the order of prayers and blessings are all examples. Rituals help define what to eat, how to behave in sacred settings and with fellow believers in sacred settings, and how one devotes one's time and resources to religious activities.

And as with positive socialization and acceptance of certain beliefs, chemical changes offset the aversive effects of stress. Rituals are followed by decreases in lactate, cortisol, and ACTH. Blood pressure decreases. Cognitive focus is enhanced. Each of these changes serves to normalize the brain and reduce aversive symptoms.

Then there is the factor of predictability. The changes we have described can be predicted from participation in the stress-reducing triad in which religions specialize: believing, socializing, and engaging in rituals. On average, this predictability far exceeds what takes place outside of religion, for example when one is at work or in the home where competition, conflict, disagreement, disregard, and disappointment are an inevitable part of the daily menu.

We return to our opening questions. If it could be shown that there is no god, no afterlife, no heaven, no hell, no grand design of the universe, no intelligent design, no Adam and Eve, no anything but nothing after death, what then? Would atheists disappear? Would agnostics acknowledge that they had seen the light? Would believers jettison their religions and beliefs and thank those who had shown that there was nothing more for humans than their brief experience here on Earth? Would prayer meetings and revivals disappear?

Again, our answer is no; these changes wouldn't occur. The why is straightforward. The alloy of ancient brain tissues and the trials each new generation endures will still stimulate people to imagine such things as heaven, hell, and nothingness following death. They will still find such thoughts aversive in that they lead to ambiguity and uncertainty. They will still suffer from aversive chemical changes due to the unavoidable stresses of everyday life as well as those that follow from what they imagine. They will still want relief from the aversive effects of these events. And they are unlikely to find it more efficiently packaged than it is in religion.

Like it or not, the brain will continue to secrete religion as long as life generates problems. □

How Religion Resists the Challenge of Science

Our evolved tendencies toward prestige bias, conformist bias, and punishing behaviors explain how social norms are maintained in cultural selection. They also explain why religious belief is immune to scientific criticism.

ILKKA PYYSIÄINEN

During the past few years we have witnessed a lively exchange of ideas between critics of religion and theologians defending religion (e.g., Dawkins 2006; Dennett 2006; McGrath 2007; Keller 2008). One line of argument is that science and religion are two "nonoverlapping magisteria," and thus there is no conflict between science and religion (Gould 1997). Science explains how the natural reality works, whereas religion deals with meaning, purpose, and value.

This argument comes in different forms. For example, it is argued that religious language does not refer to any extramental entities but rather gives symbolic form to our "feeling states" (Munz 1959). Or, religion is a "form of life"

that can be understood only from within through participation. In this view, religious belief does not necessitate any specific nonreligious beliefs about the nature of reality. Religious language is an autonomous system that can be used without having any nonreligious beliefs concerning the existence of supernatural entities (Phillips 1965; 1988; 2000); as one writer put it, "To know how to use this language is to know God" (Phillips 1965, 50).

Such arguments are meant to save religion in the face of scientific criticism. Before the advent of science, religious beliefs were mostly taken literally, as there was no alternative explanation for things such as the origins of the universe or the evolution of life on Earth. Advances in science have forced theologians to redefine God as a mere symbol instead of the ruler of the world existing in the heavens. As John Wisdom (1944) observed over fifty years ago, the existence of God is no longer an experimental issue in the way it used to be, because people have better knowledge of why things happen as they do. While questions such as "Do dogs think?" are partly metaphysical (conceptual) and partly scientific (empirical), questions about God have gradually become wholly metaphysical.

Our evolved psychology provides constraints that guide people to try to save religion even at the cost of religion losing its practical relevance. These biases work quite irrespective of whether religious beliefs actually are true or not.

A nonbeliever may wonder why theologians do not simply admit that their beliefs have been erroneous. Why continue to argue that the ultimate truth still is in God and religion when it has become difficult to say what these concepts actually mean? As Kai Nielsen (1985, 37) argues, it has become "utterly unclear what, if anything intelligible, is being affirmed that a skeptic could not affirm as well." Although, for example, Paul Tillich claims to "believe in something mysterious and profound and crucial to the human condition" of which the nonbeliever has no real understanding, he seems to be incapable of articulating what this something is. So, why is it that such commitment persists? Theories from evolutionary anthropology might help explain why it does.

Ilkka Pyysiäinen is an academy research fellow at the University of Helsinki, Finland, and author of Supernatural Agents: Why We Believe in Souls, Gods, and Buddhas *(Oxford University Press 2009). He conducts research on the cognitive foundations of religion and theology. E-mail: ilkka.pyysiainen@helsinki.fi.*

Biases in Cultural Transmission

Three interrelated factors help explain why theology seems so immune to scientific criticism. These are what anthropologists and biologist studying the evolution of human cooperation call prestige bias, conformist bias, and punishing behaviors (Richerson and Boyd 2005; Henrich and Henrich 2007, 64–68).

Prestige bias means that people are selective about those from whom they adopt ideas and beliefs. We use various kinds of cues related to skill, success, and prestige to figure out who are most likely to have useful ideas, beliefs, values, preferences, or strategies to be gleaned through observation. Social norms are preferentially learned from individuals who share the same ethnic markers, such as dialect or dress. Prestigious individuals are often trusted and imitated, even when their domain of prestige is unrelated to the opinion domain in question (Henrich and Henrich 2007, 11–12, 20).

Conformist bias means that people often copy the behaviors, beliefs, and strategies of the majority. When, for example, the accuracy of information acquired through individual learning decreases, reliance on conformist transmission increases. "Informational conformism" means that people actually change their beliefs and opinions, while "normative conformism" means that people alter their superficial behavior but not their true beliefs and opinions. Conformist cultural transmission can maintain behaviors only when they are neutral, not too costly, or if the costs are ambiguous (Henrich and Henrich 2007, 22–30, 66). Conformism works because it makes intra-group cooperation possible, and groups that are capable of cooperation tend to outperform groups that are not (Richerson and Boyd 2005; Bell et al. 2009). Prestige bias can either support conformism or compete with it, depending on the status of the prestigious persons imitated. Both biases, however, lead members of a social group to adopt similar mental representations.

Punishing refers to any behavior by which people signal disapproval of others' behavior or thinking and force them to pay a cost for their norm violation. People shun norm violation because they do not want to be punished. Thus, they may behave in accordance with social norms even if they do not truly believe in the rightness of certain norms. Punishing is a cheap strategy because it is possible to punish violators of a norm without adhering to the norm itself (Henrich and Henrich 2007, 64–67).

When this does not work, another option is to punish those who refuse to punish violators. As norm violation is rare, and failing to punish violators is rarer still, it is necessary to punish those who refuse to punish only when the first two conditions are met. Punishing those who refuse to punish is cheap in the sense that it is not needed too often. This strategy can get people "locked in" on almost any social norm. The norm itself can be beneficial, neutral, or even outright harmful and yet become stabilized (Henrich and Henrich 2007, 66–68). One example is the notorious practice in many societies of giving daughters clitoridectomies. Families that refuse to do this risk a bad reputation among their social group and run the risk of not receiving aid

from others when in need. Thus, reputation effects are linked with cooperation behavior (Henrich and Henrich 2007, 71).

Many scholars argue that religion evolved because it has made cooperation among genetically nonrelated individuals possible, especially through the idea of an all-seeing god that can reward and punish deeds that otherwise would go unnoticed (for a review, see Boyer and Bergstrom 2008). Even if this fails as an evolutionary explanation, it is true that religion can have adaptive functions in the modern world despite the fact that religion does not seem to have much effect on morality (Pyysiäinen and Hauser 2010; Sinnott-Armstrong 2009). Conformist bias, prestige bias, and punishing behaviors may help us understand why explicit commitment to theological doctrines, alongside intuitive religious beliefs (Boyer 2001, 2004), survives even when the doctrines have become rather empty of content.

Defenders of the Truth

A religious person knows that God exists and yet argues that it is utterly silly to ask for any kind of evidence of this; natural disasters such as tsunamis can be explained naturally, but people pray to God to protect them from these disasters; religion is not superstition, and yet a blessing administered by a minister or priest is believed to protect people from harm; the universe emerged from a big bang according to the laws of physics, but God is its creator; and so on. The point is, for liberal-minded theologians, God exists and acts in the world, but everything that happens can be explained without God. God is merely an unnecessary and causally impotent add-on, and yet at the same time the highest and ultimate truth. Why not say that God is no longer needed in descriptions and explanations of the universe, although people may have emotional reasons for sticking to an illusion?

Theological doctrines are defended against scientific criticism because their rejection would mean nonconformism, giving up admiration for prestigious representatives of theology, and acceptance of punishment. Whether these doctrines are true or not, or are good or bad, religious people are "locked in" on them.

Some individuals may be less prone to conformism, but at the population level conformism works—doubting or rejecting belief often necessitates finding a new social group within which conformism operates in the direction of doubt. It may also be accompanied by finding prestigious individuals from whom to learn nonreligious behavior, especially when individual learning is difficult.

Punishment for rejecting belief can take different forms. Combined with conformism, it may mean stigmatization, ostracism, and isolation from friends and relatives who are believers. It may also involve a threat of losing "salvation." It does not matter that most people have only a vague idea of what salvation actually means; to the extent that losing salvation is defined as something utterly undesirable, conformism can maintain fear of losing salvation. The medieval witch hunt is of course one of the most drastic examples of punishment, and it also involved punishing those who refused to punish (Pyysiäinen 2009, 87–88).

Criticizing critics of religion can also be viewed as a form of punishment. The interesting thing here is that it is not necessary to actually defend religious beliefs rationally or even adhere to them personally. It is enough that one criticizes those who criticize belief and those who refuse to criticize the critics of belief (punishing the nonpunishers). Criticism of the critics of religion can signal one's own commitment even when this commitment is only normative, that is, at the level of superficial behavior, rather than genuinely informational.

These factors help explain why explicit commitment to theological doctrines tends to survive despite scientific and philosophical attacks on religion and theology that force theologians to endlessly redefine religion and belief. A debate that to an outsider often seems baroque goes on and on. The issue simply is not only philosophical or one of rational debate. Our evolved psychology provides constraints that guide people to try to save religion even at the cost of religion losing its practical relevance. These biases work quite irrespective of whether religious beliefs actually are true or not. We do not accept beliefs because they are true but rather because they *seem* to be true. And what seems to be true is affected by our evolved psychology both at the levels of intuitive beliefs and of explicit commitment to commonly accepted beliefs. □

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War of the Weasels

An Evolutionary Algorithm Beats Intelligent Design

How an intelligent design theorist was bested in a public math competition by a genetic algorithm—a computer simulation of evolution.

DAVE THOMAS

In the summer of 2006, a different kind of war was waged on the Internet—a war between *computer programs* written by both evolutionary scientists and by intelligent design (ID) advocates. The war came to a climax in a public math competition in which dozens of humans stepped forward to compete against each other and against genetic ("evolutionary") computer algorithms. The results were stunning: The official representative of the intelligent design community was outperformed by an evolutionary algorithm, thus learning Orgel's Second Law—"Evolution is smarter than you are"—the hard way. In addition, the same IDer's attempt to make a genetic algorithm that achieved a specific target without "specification" of that target was publicly exposed as

a rudimentary sham. And finally, two pillars of ID theory, "irreducible complexity" and "complex specified information" were shown not to be beyond the capabilities of evolution, contrary to official ID dogma.

Genetic Algorithms

"Genetic algorithms" (GAs) are computerized simulations of evolution. They are used to study evolutionary processes and solve difficult (and sometimes intractable) design or analysis problems. Several novel designs generated with genetic algorithms have been patented (Brainz.org 2008). Evolutionary algorithms are currently used in a variety of industries to get effective answers to very difficult problems, including problems whose brute-force solutions would require *centuries*, even on superfast computers. In contrast, GAs can often produce highly useful results for the same problems in just a few minutes.

The basic idea for a genetic algorithm is simple. You start with a randomly generated "herd" of possible solutions to a given difficult problem, where the general structure of any conceivable solution can be represented with a chunk of memory in a computer program. Treat the members of this herd as "organisms," and test every herd member's performance with a *fitness function*. While the fitness function *can* be written in terms of proximity to a distant known "target," it is more often just a straightforward calculation of some parameter of interest, such as the length or cost of some component or feature, or perhaps the gain of a wire antenna. Any candidate organism can have its fitness readily measured, and the performances of any number of candidates can be impartially compared. The fitness test is commonly used to help decide which organisms get to be "parents" for the next generation of organisms. Throwing in some mutations, and letting higher-fitness organisms breed for a few hundred generations, often leads to surprising (and sometimes even astonishing) results.

Creationists and intelligent design proponents vigorously deny the fact that genetic algorithms demonstrate how the evolution of novel and complex "designs" can happen. They claim that GAs cannot generate true novelty and that all such "answers" are surreptitiously introduced into the program via the algorithm's fitness testing functions. The support for this claim stems mainly from a few pages of a book Richard Dawkins wrote nearly twenty-five years ago.

Dawkins and the Weasel

Creationists have been fixated for decades on Richard Dawkins's "Weasel" simulation from his 1986 book *The Blind Watchmaker* (Dawkins 1986). Unlike real genetic algorithms developed for industry or research, Dawkins's Weasel algorithm included a very precise description of the intended target. However, this precise specification was used only for a *tutorial demonstration of the power of cumulative selection* rather than for generation of true novelty. In the Dawkins example, the known target is the phrase from Hamlet, "Methinks it is like a weasel." The organisms are initially random strings of twenty-eight characters each. Every generation is tested, and the string that is closest to the target Weasel phrase is selected to seed the subsequent generation. The exact Shakespearean quote is obtained in just a few dozen generations. Despite Dawkins's explicit disclaimer that, in real life, evolution has no long-distance target, creationists of all varieties have latched on to "Weasel" as a convenient straw version of evolution that is easy to poke holes in.

The main ID theorist dealing with genetic algorithms is William Dembski, who stated the ID/creationist position as of September 2005 with these words:

> And nevertheless, it remains the case that *no genetic algorithm or evolutionary computation has designed a complex, multipart, functionally integrated, irreducibly complex system without stacking the deck by incorporating the very solution that was supposed to be attained from scratch* (Dawkins 1986 and Schneider 2000 are among the worst offenders here). (Dembski 2005)

Stephen Meyer is a top gun in the Discovery Institute's Center for Science and Culture, the Seattle-based center of ID pontification and promotion. In Meyer's "peer-reviewed" ID paper, "The Origin of Biological Information and the Higher Taxonomic Categories," he states:

> Genetic algorithms . . . only succeed by the illicit expedient of providing the computer with a target sequence and then treating relatively greater proximity to future function (i.e., the target sequence), not actual present function, as a selection criterion. (Meyer 2004)

Both Dembski and Meyer cite Weasel in these statements and go on to claim that *all* GAs are similarly targeted. And that is the gist of the formal ID response to genetic algorithms: paint them all with the Weasel brush, and pretend they all need predefined targets to work.

Steiner's Problem

In 2001, as I was preparing a response to an upcoming talk by ID's Phillip Johnson at the University of New Mexico, I decided to address the Weasel problem. I set out to develop a genetic algorithm of my own for solving difficult math problems, without using *any* specified target. I wanted something visual yet simple—a sort of miniature digital playground on the very edge of complexity. I ended up choosing "Steiner's Problem": given a two-dimensional set of points, find the most compact network of straight-line segments that connects the points (Courant and Hilbert 1941).

In Steiner's problem, there can be variable "Steiner points" in addition to the fixed points that are to be connected. If there are four fixed points arranged in a rectangle, the Steiner solution consists of five segments connected in a bowtie shape; each of the points on the rectangle's corners connects to one of two Steiner points in the interior of the rectangle, and a fifth segment connects the two Steiner points (figure 1).

Dave Thomas, a physicist and mathematician, is president of New Mexicans for Science and Reason and a fellow of the Committee for Skeptical Inquiry. He is currently a scientist/programmer at IRIS/PASSCAL in Socorro, New Mexico. E-mail: nmsrdave@swcp.com.

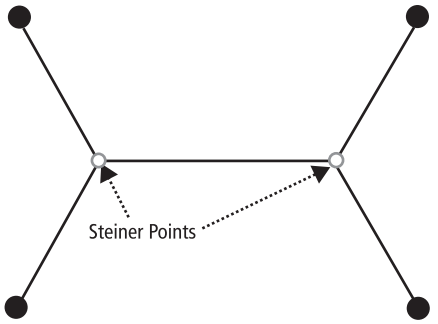


Figure 1: The bowtie, the Steiner solution for four fixed points (solid)

A Genetic Algorithm for Steiner's Problem

In my Steiner genetic algorithm, the organisms are represented by strings of letters and numbers—a kind of primitive "DNA." Two such DNA strands are shown in figure 2. The strands, when read by the transcription routine, supply three types of information about the network represented by each organism: the number of Steiner points, the numerical locations of these points, and a true/false connection map that dictates which points are to be connected by segments.

$$0^{8}5^{3}4^{2}2^{8}1^{0}6^{6}7^{4}2^{4}F_{F}T_{T}T_{F}^{F}T_{T}F_{F}T^{F}$$

$$0^{6}4^{6}7^{3}5^{5}5^{8}9^{2}3^{0}2_{F}T_{T}T_{T}^{F}F_{T}T_{F}F_{T}$$

Figure 2: Two organisms represented by alphanumeric DNA

Steiner points can be placed anywhere in the region encompassing the fixed points; for these simulations, the region is a square with 999 units on a side. Length is measured in these units; for example, the length of the horizontal segment joining points (550,600) and (650,600) is 100 units.

Some representative networks for a six-point Steiner problem appear in figure 3. These are the "phenotypes" that correspond to the transcription of DNA (or the "genotype"). The fitness function used tests for two things: Are the fixed points all connected? What is the total length of all "expressed" segments? It's critical to emphasize that the fitness function need not have any descriptions of the actual Steiner solution for any given set of points. Fitness, here, is not based on any specific future function but only on present function. For example, the two organisms of figure 3 are clearly *not* the optimum Steiner solution for six fixed points (solid circles) in a rectangle. Yet, they can both easily be evaluated for *current function*. Here, the organism on the right is considerably shorter than the one on the left, and thus it has a better chance of having its "seed" continue on to the next generation. If an organism fails to connect all the given points, it is given a large "death" length of 100,000 units, making it extremely "unfit."

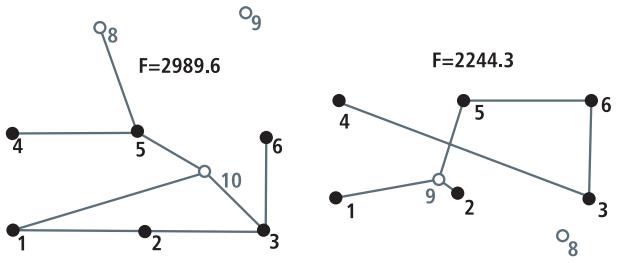


Figure 3: Two organisms shown as phenotypes (candidate networks after DNA transcription). While both organisms connect all fixed points, the right-hand creature is shorter and therefore more likely to be selected for breeding.

The Cyber Battles Begin

I posted a detailed discussion of this work on the Panda's Thumb blog (www.pandasthumb.org) on July 5, 2006. The point of that report was to demonstrate that genetic algorithms can solve difficult problems without knowing anything about the answer(s) in advance. I demonstrated that, while occasionally producing the correct (Steiner) solution, most of the time the algorithm converged on *imperfect* solutions. I called these "MacGyver" solutions, after the television hero who often found clever ways to get out of tough fixes. While the MacGyver solutions are clearly not the optimum Steiner shape, they get the job done efficiently and are often *within one percent of the length* of the formal Steiner solution itself. The GA operates by seeding the next generation with those organisms that are shorter in length in the current generation. This GA does *not*, as Meyer falsely claims, select for *future function* (a precise target) rather than for *present function* (here, the lengths of the digital creatures).

The ID community responded to my article by simply reiterating their claim that the solutions were secretly introduced via the fitness function. IDers are desperate to make Dawkins's Weasel the poster boy for all GAs, and they continue to paint all GAs as similarly "target-driven" or "front-loaded." Some ID theorists have tried to skirt the obvious lack of specific target description in the Steiner genetic algorithm by claiming that its virtual environment—the condition "shorter is better"—is really a description of the "precise target" itself. They say, "After all, you wanted shorter networks, and the Steiner solution is defined as the shortest network, so you are selecting for a specific target!"

This ID argument fails because the specific details of complex solutions are *not* explicitly imbedded in the overall design goals. To use an analogy, simply stating the objective "Build a vehicle that can carry men to the Moon and back" does not result in the spontaneous appearance of the complete plans for an Apollo spacecraft (with separate command, service, and lunar modules), along with a Saturn V launch vehicle.

The Collapse of the Pillars of ID Theory

One reason I chose Steiner's problem was that Steiner solutions possess "irreducible complexity" (IC) and also exhibit "complex specified information" (CSI), two features that intel-

ligent design theorists claim are impossible via evolutionary processes. I contend that the results of the GA—both Steiners and MacGyvers—exhibit IC: if any segment is removed or rerouted, basic function of the system (here, connecting the fixed points) is lost completely. In addition, the Steiner solutions themselves are CSI, by virtue of their being complex (in the sense that the correct answer is rare enough to be improbable) and by virtue of their nature as specified information (as the formal solution to a given math problem).

ID proponents responded by claiming that the Steiner solutions discussed were "not really IC," even though these solutions obviously represent "a single system composed of several well-matched, interacting parts that contribute to the basic function, wherein the removal of any one of the parts causes the system to effectively cease functioning," the very definition of IC from Michael Behe's book *Darwin's Black Box* (Behe 1996). Behe goes on to claim that IC structures are impossible in gradual evolution (improvement by slight, successive modifications to precursor systems) "because any precursor to an irreducibly complex system that is missing a part is by definition nonfunctional."

The general ID response to my article was that the Steiner solutions could *not* be IC because they were derived from *ancestors* that were longer but still functional. So, the very existence of functional precursors is now being used to redefine irreducible complexity. IC apparently no longer has anything to do with the existence of critical, precisely interlocking components. This is classic goal-post movement. The concept of IC has become a useless tautology: if it's IC, it can't have evolved, and if it evolved, it can't be IC. Of course, Behe was thinking only about bottom-up evolution initially. In the Steiner GA, however, populations of organisms often become less complex through shedding of *redundant complexity*. This type of pathway to IC structures has been observed numerous times in nature.

The ID Version of a Genetic Algorithm

Bill Dembski's coauthor of his Uncommon Descent blog, software engineer Salvador Cordova, was the most prominent member of the ID community to weigh in on the series of GA articles. Cordova repeatedly misrepresented GAs as necessarily "front-loaded" and dismissed the results as "computational theatrics." On August 15, 2006, Cordova posted *his* code for a genetic algorithm, which he contended could solve for the sum of the first 1,000 integers *without specifying the answer*. He said this program was based on the same "theatrics" I was employing in my Steiner GA. However, I proved that his program was, despite copious amounts of smoke and mirrors, simply a direct method of specifying the answer, or target. Instead of matching the string "Methinks it is like a weasel," Cordova engineered his GA to converge on the specific target sequence 251, 252, 253, . . . 750. Cordova then added these 500 numbers and doubled that sum, inevitably arriving at the sum of the integers from 1 to 1,000, or 500,500. It was easy to prove that his badly written and confusing program was a direct encoding of a fixed target, leading directly to the summation of the first N integers.

The Design Challenge

On August 14, 2006, I posted a public "Design Challenge" on the Panda's Thumb blog in which readers were given one week to submit answers for the tricky six-point Steiner system

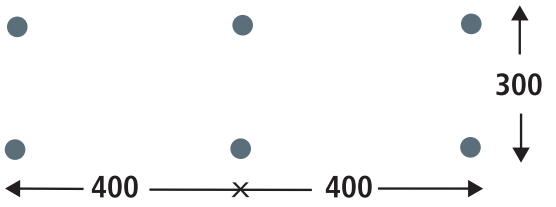


Figure 4: The public Design Challenge: Find the Steiner solution for the six-point grid shown.

shown in figure 4. It was an open-book test. Since the ID person responding to this discussion, Salvador Cordova, had been claiming that the answer was "front-loaded" into the fitness test, I challenged him to follow that lead to the answer.

I had come up with the six-point problem two days earlier, while trying to design a system that would have the "double bowtie" as its Steiner solution (figure 5). Upon reviewing an overnight batch of three-hundred runs, however, I was surprised to see solutions with lengths much *shorter* than the double bowtie's 1,839 units. And when I checked out the GA's best solution, the odd design shown in figure 6, it was like finding a diamond in the rough. I realized the GA had found the correct Steiner solution, and it *wasn't* what I had been expecting at all. Instead of the double bowtie, the actual Steiner solution twists both bowties a bit, and they become conjoined in a three-segment "dogleg" along the center vertical. There are two possible Steiners, one with the bowties skewed up and the other with them skewed down. The GA found both solutions, along with hundreds of compact MacGyvers.

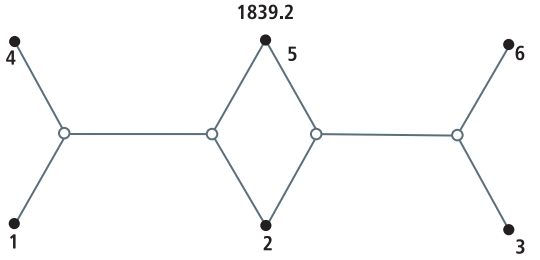


Figure 5: The double bowtie turns out to be a long and inefficient candidate solution for the six-point problem. It is a low-grade MacGyver.

Dozens of Panda's Thumb readers responded to the Design Challenge. Most were pro-science enthusiasts, but ID theorist Cordova submitted several candidate answers as well. Cordova

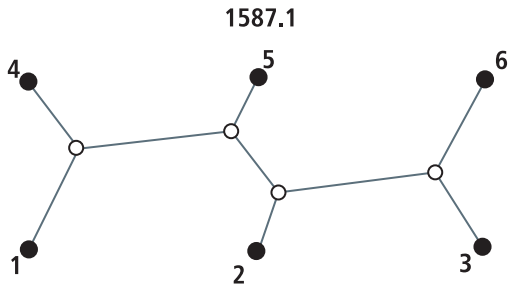


Fig. 6: The actual Steiner solution for the six-point problem has two bowties, twisted and conjoined in the middle, forming a hexagonal grid. It is a far more efficient solution than the double bowtie of figure 5.

had repeatedly compared the Steiner GA's fitness function to a T-shirt with a large bull's-eye emblazoned on it and the Steiner solution itself to the person inside that shirt. He analogized shooting a paintball gun at the bull's-eye symbol and then telling the victim, "Don't be mad, I wasn't aiming at you, I was aiming at the shirt you were wearing." Curiously, Cordova did not reverse-engineer my publicly posted GA (the shirt) to deduce the solution (e.g., the person wearing the shirt). Instead, he went the traditional route and tried to design an answer using Fermat points and trigonometry. Interestingly, Cordova failed to deduce the basic network shape for the six-point solution, finding instead the slightly longer MacGyver solution of figure 7. Fifteen other "intelligent designers" (humans, in other words) were able to derive the *correct* answer—the true Steiner solution. However, all of these humans were pro-science skeptics of intelligent design creationism. Correct solutions were also found by not one but two independent genetic algorithms! An additional fifteen designers derived various MacGyver solutions, thus proving these, too, are complex specified information.

And that's how ID theorist Cordova learned the true meaning of what Daniel Dennett terms Leslie Orgel's Second Law: "Evolution is smarter than you are."

After being bested by an evolutionary algorithm, Cordova changed his tune and moved the goalposts over to computer speed. He said there was no shame in being beaten by the computer because computers are designed to do lots of math very, very fast and are thus superior to humans in that regard.

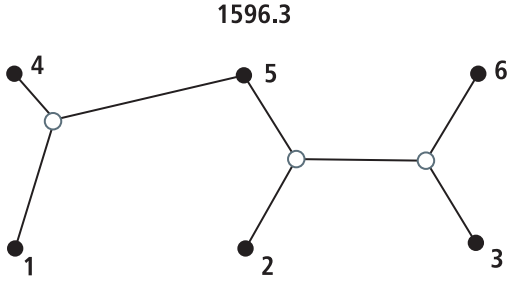
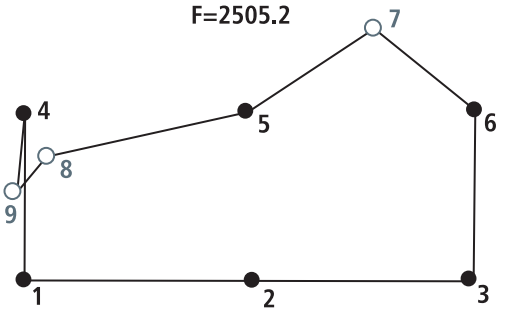


Figure 7: This shape is not the Steiner solution but is the closest second, or "best MacGyver." This solution was the final Design Challenge submission by ID theorist Salvador Cordova.



Best of 404,576,000 Random Trials
Found on Trial #277,033,051

Figure 8: Random guessing is a totally inefficient method of trying to solve the problem. Even at a blazing 8,000 organisms per second, days of frantic computation don't even come close to producing what the GA can produce in just ninety seconds.

But that argument doesn't wash either. The computer can check out lots of random solutions very quickly (about 8,000 per second), but simply guessing randomly at the answer is a terrible way to solve the problem. After dozens of hours, random guessing couldn't come close to matching even one of the efficient designs the genetic algorithm was pumping out every ninety seconds (figure 8).

Conclusion

The 2006 "War of the Weasels" was, to say the least, not kind to the ID movement. The central dogma of ID regarding genetic algorithms—the Weasel offense—was definitively and publicly shot down. ID theory's two main "evolution stoppers"—irreducible complexity and complex specified information—were shown to be child's play for an evolution-based program that evaluates current function only and is mindless of any specific future optimum. Finally, an ID "theorist" was bested by a program that used evolution to derive solutions. Check out the complete archives of the War of the Weasels on the Panda's Thumb blog, www.pandasthumb.org, in the "Evo Math" category. □

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Online Extra!

For a fascinating look at real-world Steiner solutions, check out the Online Extra at www.csicop.org/SIExtras.

Power Balance Technology

Pseudoscientific Silliness Suckers Card-Carrying Surfers

Carrying a Power Balance card in your pocket will supposedly improve your athletic performance and cure what ails you. The alleged mechanism ("frequencies" in an embedded hologram) is laughable pseudoscientific bunk.

HARRIET HALL

Remember when professional golfers were wearing Q-ray bracelets to improve their game? The Q-ray folks recently had a run-in with the courts. They admitted their product was only a placebo but argued that it was acceptable to lie to elicit the placebo response. The judge disagreed: they were convicted of fraud, forced to pay back $16 million, and required to remove the deceptive claims from their advertising. Now they have a new competitor: Power Balance Performance Technology. Like the Q-ray bracelet, it is based on "resonance." It doesn't even have to come in contact with your body: one version is a card that you simply put in your pocket.

Power Balance representatives demonstrate their products in sports stores at malls. They test your strength and balance and then give you a Power Balance card to hold or put in your pocket. When they retest you, you miraculously do better. There are some revealing videos on YouTube, including a short clip that shows the subject standing on one foot with arms outstretched (www.youtube.com/watch?v=8e6DnNARz60). The salesman pushes down on the subject's arm near the wrist, and the subject starts to fall over. After the subject puts a Power Balance card in his pocket, the salesman repeats the test but this time pushes down near the elbow, creating a shorter lever arm that of course reduces the effect of the force applied, so the subject doesn't fall over. In other demonstrations, they use other simple biomechanical tricks like this to create false impressions of improved strength. The amount of force applied is subjective, both parties know when the card is in use, and they know what is expected to happen—it's a recipe for self-deception.

What's in these magic cards? I will quote at length from their Web site for the entertainment value:

> POWER BALANCE Performance Technology has been embedded with naturally occurring frequencies found in nature that have been known to react positively with the body's energy field. This helps to promote balance, flexibility, strength and overall wellness.
>
> For thousands of years, eastern medicine has been using the same techniques for personal wellness through finding things in nature that react positively with your body, such as rocks, minerals, crystals, etc. Through kinesiology we have learned that certain foods cause the body to react either positively or negatively as well. Although not all substances found in nature work the same on everyone, we have narrowed it down to a few that we believe are highly beneficial and have put them together to create Power Balance Performance Technology.
>
> It's hard to argue with nature and the fact is that everything in nature resonates at a particular frequency. That is what keeps it all together. We react with frequency because we are a frequency. Most simply, we are a bunch of cells held together by frequency. If you hold processed sugar or a cell phone in your hand and hold your arm straight out to your side and have someone push your arm down while you resist, it goes down pretty easily because processed sugar and cellular telephones do not react positively with the human body. Basically, the frequencies in sugar and cell phones create a reaction that makes your body weaker. Adversely, if you put certain vitamins or minerals in your hand and do the same test with your arm, you will find it is much harder for that person to push your arm down. Your body's energy field likes things that are good for it and craves to be around those things. At Power Balance, we have taken a few of those items and through advances in technology, have been able to duplicate those positive energies and imprint them onto our holographic media.
>
> Why Holograms? We use holograms because they are composed of Mylar—a polyester film used for imprinting music, movies, pictures, and other data. Thus, it was a natural fit. In fact, the hologram is so complex with such infinite depth and minimal surface area, that many companies are now using them as hard drives. Along those same lines, we felt that it would be a lot easier to get someone to put a hologram in there [*sic*] shoe rather then [*sic*] a Power Balance equipped rock or apple.

Power Balance products include a ten-pack of stick-on embedded holograms ($59.95), a pendant ($39.95), a wristband ($29.95), and an eight-pack of pocket cards ($59.95).

The company targets athletes, particularly surfers. According to numerous testimonials, Power Balance seems to improve performance. One surfer claims he can even sense the presence of the card: "I can feel it on me." Another testimonial is from Tommy Grunt, United States Marine Corps. Maybe Grunt is real, but ads for quack products have been known to feature fabricated testimonials, and I can easily imagine a copywriter putting tongue in cheek and creating a name like that to relieve the boredom. There are reports of the products' effectiveness in animals, from horses to birds. The products allegedly relieve headaches, menstrual pain, and all kinds of other symptoms. The testimonials give the impression that if you feel unwell in any way, the magic card will restore you to normal. If you already feel well, it will make you better than normal.

"A primitive form of this technology was discovered when someone, somewhere along the line, picked up a rock and felt something that reacted positively with his body." I don't doubt that someone believed he felt something, but I seriously doubt it was due to the frequency of the rock resonating with the frequency of his body.

For resonance to occur, something has to vibrate. You may be able to make a rock resonate, but the rock doesn't create its own vibrations. Crystalline structures can be made to vibrate. The tympanic membrane and the vocal cords vibrate, but the whole body doesn't. When a soprano wants to break a glass with her voice, she can first listen to the sound made by tapping it with a spoon; if she can match that sound frequency, the glass will resonate and possibly shatter. How can you tap a cat to see what its frequency is? Can you imagine a soprano shattering a cat?

This whole resonance and vibration business is pseudoscience emanating from the myth of the human energy field—

Harriet Hall, MD, writes about pseudoscience and questionable medical practices. She is a SKEPTICAL INQUIRER *contributing editor and a newly elected fellow of the Committee for Skeptical Inquiry. She is one of five MD founders of the Science-Based Medicine blog. Visit her Web site at www.skepdoc.info and reach her by e-mail at harriet.hall@comcast.net.*

not the kind of energy physicists measure but some vague life energy like the acupuncturists' *qi*, the chiropractors' Innate, and the imaginary fields that Therapeutic Touch practitioners claim they are smoothing down with their hands. "We are a frequency" and "We are a bunch of cells held together by frequency" and "Your body's energy field likes things that are good for it" are statements so incoherent, so much at odds with scientific knowledge, that they "aren't even wrong."

The definition of *frequency* is "the number of repetitions of a periodic process in a unit of time." A frequency can't exist in isolation. There has to be a periodic process, like a sound wave, a radio wave, a clock pendulum, or a train passing by at the rate of *x* boxcars per minute. The phrase "33 1/3 per minute" is meaningless: you can't have an rpm without an *r*. A periodic process can have a frequency, but an armadillo and a tomato can't. Neither a periodic process nor a person can "be" a frequency.

Pushing down on the arm is a bogus muscle testing technique known as applied kinesiology. It is supposedly used to diagnose allergies: if you hold a sealed vial of an allergen, your strength supposedly diminishes. It only works if the doctor and patient know what substance is being tested; when double-blind controls have been used, kinesiology has failed every test.

Omitting for a moment the crucial question "Frequencies of what?" how did the Power Balance creators determine which frequencies to use? "We have narrowed it down to a few that we believe are highly beneficial." Okay . . . how exactly did they measure the frequencies, and what criteria did they use to narrow them down? I think the wording of the ad is revealing: the company says they "believe" they are highly beneficial, not that they have any *evidence* that they are—assuming there really are any frequencies and that they have somehow put them in a hologram. I e-mailed the company and asked simple questions like "How do you measure the frequency of a rock?" They didn't answer.

In online discussions, one man "tested" the product by having one hundred athletes try it, with no controls of any kind; not surprisingly, all of the athletes reported improvement. A man watching a demonstration suggested a real test, blinding the subject as to whether the card was present, but (not surprisingly) the salesman wouldn't cooperate.

This would be so simple to test properly. Take five Power Balance cards and five credit cards, put them in opaque envelopes, shuffle, number the envelopes 1 through 10, have a third party slip an envelope in the subject's pocket, and then challenge the salesman to tell which envelopes had the real card. I could not find evidence that they have ever done such a test, presumably because they know it would fail.

These products may actually do some good. Modern versions of an amulet or rabbit's foot (without harm to rabbits), they elicit a placebo response, giving people confidence and possibly making them try harder. They are not exorbitantly expensive and even come with a money-back guarantee.

The marketing is pure genius. If I were a professional scam artist, I don't think I could come up with anything better. The company has an impressive trick demonstration that easily fools most people. They spout a lot of pseudoscientific hooey that sounds impressive to the scientifically illiterate, but they are careful to make only vague claims that the Federal Trade Commission can't object to. The harmless products are inexpensive to manufacture, but the company charges enough to afford a money-back guarantee and still make money. They package the cheaper cards and stickers in multiples so they can charge more, but the prices are still low enough that the average person is willing to take a chance. Who knows what is actually in the products? If it were my scam, I'd put in any old hologram or none at all. No one is likely to investigate your production line to see how you get all those "beneficial frequencies" into the Mylar.

Tell me you use the Power Balance card and it makes you feel better, and I can readily believe you. Tell me your performance improves when you carry it, and I will believe you. But that won't convince me that the improvement has anything to do with bioresonating frequencies in the holograms—or even with the cards themselves.

It's like the tooth fairy. Tell me money appears under your pillow, and I will believe you. But that won't convince me that the tooth fairy did it.

The Power Balance phenomenon is easily explained by suggestion, confirmation bias, the placebo response, and other well-known aspects of human psychology that conspire to persuade people that ineffective things work.

The tooth fairy phenomenon is easily explained by human psychology and parental behavior. The Power Balance phenomenon is easily explained by suggestion, confirmation bias, the placebo response, and other well-known aspects of human psychology that conspire to persuade people that ineffective things work.

Before writing this article, I discussed with CSI Research Fellow Benjamin Radford whether the Committee for Skeptical Inquiry might want to do a simple double-blind test. We decided not to because it is just too silly to bother with. As Radford put it, "This sort of scientific testing should be done by the company; it is not the skeptics' job to spend time and money testing outlandish claims for which no reliable evidence has been offered."

We're not going to bother setting up a video camera to catch the tooth fairy either. □

The Alarms of Hormone Replacement Therapy

Are They Supported by the Data?

Does taking hormones increase the risk of breast cancer for women, as the Women's Health Initiative claims? An oncologist and a social psychologist take a critical look at the data behind the alarming headlines.

AVRUM Z. BLUMING AND CAROL TAVRIS

In almost every news report about breast cancer nowadays, you will read that hormone replacement therapy (HRT), which many women take to alleviate the symptoms of menopause, "causes" or "significantly increases the risk of" breast cancer. You will also read that thanks to the just-in-time reports from the Women's Health Initiative (WHI), millions of women stopped taking HRT—and rates of breast cancer plummeted within six months. In a front-page *New York Times* article, health reporter Gina Kolata noted that one of the most effective things that women can do to reduce their chances of breast cancer is to stop taking hormones (or never start taking them). Social critic Barbara Ehrenreich, noted for her clear-eyed skepticism, now attributes her own

breast cancer to having taken hormones years earlier.

From 2002 to 2008, yearly reports from the federally funded WHI claimed that hormone therapy administered to women during and after menopause significantly increased the risks of breast cancer development, cardiac events, Alzheimer's disease, and stroke. Thus, on July 9, 2002, the National Institutes of Health (NIH) issued a press release: "The National Heart, Lung, and Blood Institute of the NIH has stopped early a major clinical trial [by the Women's Health Initiative] of the risk and benefits of combined estrogen and progestin in healthy menopausal women due to an increased risk of invasive breast cancer." The WHI investigators reported that women who had been randomly assigned to take a combination of estrogen and progestin had a small increased relative risk of breast cancer (RR = 1.26) compared to women who were randomly assigned to a placebo. Those findings did indeed cause an almost immediate and sharp decline of 50 percent in the numbers of women taking hormones for symptoms associated with menopause.

There are only three problems with the WHI's findings:

1. Virtually none of them were statistically significant, but they were always reported as if they were: "The 26% increase in breast cancer incidence among the HRT group compared to the placebo group almost reached nominal statistical significance." "Almost," of course, means it did *not* reach statistical significance.

2. Overall rates of breast cancer in the U.S. began to drop in 1999, and a decreasing death rate from breast cancer can be traced back to 1990. Estimates of the time it takes for a malignant cell to develop into a clinically detectable breast cancer range from two to twenty-six years, with an average of about eight years.

3. The WHI reported its findings in terms of relative risks, not absolute numbers, a manipulation that makes results that are statistically modest or borderline look more impressive than they actually are.

To put the alleged dangers of HRT in perspective, table 1 lists many factors that have been reported to have an even *greater* increased risk of causing breast cancer than hormones: eating fish or grapefruit; having one additional serving of French fries per week; working on a night shift; working as an airline flight attendant in two different airlines; suffering from severe caloric restriction during the 1944–1945 Dutch famine; taking antibiotics; being left-handed; and using electric blankets. Why was there no hue and cry to ban electric blankets or prohibit grapefruit? Because these associations are clearly spurious and unlikely, and indeed they have not been replicated. In contrast, note what the relative risk is for a *real* danger—smoking and lung cancer—at the bottom of the table.

Alleged Risk Factors in Breast Cancer

Risk factor	Relative Risk (RR)
Conjugated equine estrogen	0.77
Fish intake	1.14
Premarin/Progestin (WHI)	1.24
Premarin/Progestin (WHI)	1.26
French fries (1 extra serving/week)	1.27
Grapefruit intake	1.30
Night shift work	1.51
Flight attendant (Finnish)	1.87
Dutch famine	2.01
Antibiotic use	2.07
Left handedness (premenopausal)	2.41
Flight attendant (Icelandic)	4.10
Electric blanket use	4.90
Tobacco smoking and lung cancer	26.07

Table 1. This table lists various factors, all reported in the medical literature, that supposedly increase the relative risk of breast cancer. Note that hormone replacement is actually a *lower* risk than almost all of the other factors, but there was no call for women to stop eating French fries or grapefruit. These associations are weak, spurious, or unreplicated—except for the *real* finding, the link between smoking and lung cancer.

We are not lobbyists for the pharmaceutical industry, and we don't argue that all women after menopause *should* take hormones to be "feminine forever." Indeed, the majority of American women do not take any form of HRT during or after menopause; of those who do, most take it for fewer than five years, though some take it for the rest of their lives. Our interest, rather, is skeptical inquiry: what do the data really show?

No one disputes that HRT is highly effective in alleviating the most common menopausal symptoms, including hot flashes, night sweats, emotional lability, palpitations, insomnia, uncomfortable and frequent urination, and painful sexual intercourse. But when the WHI began trumpeting the alleged dangers of hormone replacement therapy, people paid attention because the WHI's is the largest prospective study in which women were randomized to take hormones or a placebo and then followed over time. An earlier prospective, randomized, double-blind study had found no increased risk of breast

Avrum Z. Bluming is a board certified oncologist, hematologist, and internist. He is a former senior investigator for the National Cancer Institute, a master of the American College of Physicians, and a clinical professor of medicine at the University of Southern California.

Carol Tavris, a fellow of the Committee for Skeptical Inquiry, is a social psychologist, writer, and lecturer. She is a fellow of the Association for Psychological Science and coauthor of two leading psychology textbooks. Her most recent book is Mistakes Were Made (But Not by Me) *(with Elliot Aronson). E-mail correspondence regarding this article may be sent to Dr. Bluming at avrumzbluming@yahoo.com.*

cancer in women on HRT, even after twenty-two years, but this small study never made headlines.

The WHI research has cost nearly a billion dollars; the investigators consist of eminent physicians, statisticians, and epidemiologists across the country; and the findings have been published in medicine's most prestigious journals. But might does not make right—in war or science. When we looked closely at the WHI's findings, placing them in the context of research on HRT over the past decades, we were surprised by the enormous discrepancy we found between the belief that hormones are dangerous and the lack of supporting data.

Data Dredging: The 'There's a Pony in Here Somewhere' Problem

Two statistical errors common in research on HRT have contributed to confusion about its risks and benefits: one is the misleading habit of reporting relative risks instead of absolute risks; the other has to do with the often inappropriate "mining" of data, when researchers retrospectively hunt around in their findings for something, *anything*, that might appear to be a significant risk factor. This practice, severely frowned upon in research, is called retrospective substratification, commonly known as "data mining" or "data dredging." Data mining occurs when researchers, having failed to find the statistically significant associations that they had originally hypothesized would exist between a possible risk factor and a disease, go back into their data and rummage around, looking for other factors that might show a statistical link to the dependent variable in question. This effort might yield interesting questions or hypotheses for future research, but the problem is that in a data set of many thousands of people, *some* relationship that is unearthed retrospectively will turn out to be statistically significant just by chance.

A now-famous example of the spurious results that can emerge from data mining can be found in an article that was submitted to *The Lancet* in 1988, reporting that men hospitalized for acute heart attacks who had been taking an aspirin daily had a better survival rate than similarly hospitalized men who had not been on aspirin. This was clearly an important finding, and the editors agreed to accept the paper with one condition: the authors would have to retrospectively substratify the 17,187 men in their study according to a variety of factors, including the men's age, weight, and race. It would certainly be good to know whether the benefit of taking aspirin (or any other drug) is affected by how old you are, whether you are overweight or Asian, or other possible demographic factors. But the authors refused to do this reanalysis, explaining that the benefit or risk for these subcategories would be best assessed by a new prospective study. The editors insisted: no substratification, no publication. And so the authors eventually turned in a revised paper with the additional findings, which included a slightly adverse effect of aspirin on mortality in patients born under the astrological signs of Gemini or Libra, in contrast to a strikingly beneficial effect of aspirin in patients born under all other astrological signs. The editors agreed to publish the paper if the astrological results were omitted. You asked for this, the authors said, and demanded that *The Lancet* stick to the deal. And so this landmark paper was published—along with a discussion and critique of the astrological findings.

HRT and Breast Cancer: Is There a Link?

Let's look at what the WHI actually found:

2003: HRT "increases the risk of invasive breast cancer" and "significantly increased the incidence of breast cancer within a five-year period." The relative risk, 1.24, was actually a bit lower than the 2002 finding of 1.26, and it barely achieved statistical significance.

2006: No increased risk of breast cancer among women on HRT. The "significant" relative risk had completely vanished. This news did not make headlines.

2008: Increased risk of breast cancer in women taking HRT for five years; this increase was not statistically significant.

One of the studies still frequently cited by those striving to find an association between HRT and breast cancer is a 1989 Swedish study that reported a 440 percent increased risk of breast cancer among women taking combined estrogen and progestin for more than six years. A 440 percent increased risk sure sounds scary! However, it was based upon only ten patients in the study who developed breast cancer while taking HRT. The baseline study population consisted of the 23,244 women in Uppsala, Sweden, who received prescriptions for HRT in a three-year period. The researchers took a much smaller subset of that population to analyze, calculated that 2.2 women would be expected to get breast cancer, and found that ten actually did—hence the "440% increased risk." And that increase was not statistically significant.

Data mining is also endemic in many of these studies. A 2000 article reported a 40 percent increased risk of breast cancer associated with HRT, much higher than the WHI's first report. But getting that result took determination, because the increased risk applied only to women weighing no more than ninety-one pounds. Similarly, several of the associations in table 1 were a result of data mining: the use of antibiotics increases relative risk but not among women using tetracycline or macrolide for acne or rosacea (apparently breast cancer needs to know why a woman is taking an antibiotic). The increased risk associated with surviving the Dutch famine occurs only among women who were between two and nine at the time. And, in the most unintentionally funny result, the breast cancer risk associated with using electric blankets increases among African American women who have used the blankets for more than ten years—but only if those who used them for more than six months per year were *excluded* from analysis.

We repeat: when you get results from retrospective analysis rather than from a premeditated focus of investigation under controlled conditions, the findings are likely to be confusing, unreplicable in subsequent studies, and biologically improbable—like the spurious link between the efficacy of aspirin and astrological sign. And that is the picture we get of the relationship between HRT and breast cancer. Thus, when one large study found no increased risk of breast cancer among women on HRT, the researchers then compared women who

had *ever* used HRT with women who had *never* taken it. Still the results were good news: no increased risk of breast cancer even among women who had taken HRT for over ten years, compared to those who had never used HRT. So the researchers then further substratified their sample into (a) current users of HRT and (b) women who had used HRT in the past and had stopped. This time the investigators found an increased risk of breast cancer but only among women who were currently on hormones and had been for at least five years. How can you get an increased risk among a group of women who have taken hormones for five years but not for more than ten years? That is what data mining gives you.

Even some investigators who believe that the relative risks of HRT are serious enough to warrant concern acknowledge that the *absolute* risks from this treatment are small. In one worst-case analysis, researchers calculated that a fifty-year-old woman taking estrogen and progestin for ten years has only a 4 percent risk of breast cancer. Without HRT, her risk would be 2 percent. (Another way of saying this is that she has a 96 percent chance of remaining free of breast cancer if she uses HRT versus 98 percent if she does not.) Moreover, even if HRT increases the risk of breast cancer by this modest increment, other research suggests that women on HRT live longer than those not taking HRT and that HRT-treated women have a lower death rate from breast cancer. How can the very hormones that allegedly increase the risk of breast cancer also be responsible for a better survival rate from that cancer?

But *Does* Estrogen Cause Cancer?

The hypothesis that hormones are linked to breast cancer was originally derived from two well-documented facts: the incidence of breast cancer is one hundred times greater in women than in men, and the earlier a woman's menarche and the later her menopause, the greater her risk of breast cancer. These observations suggested, reasonably, that perhaps having more years of circulating estrogen was the culprit. To test that hypothesis, the first step is to document a reliable association; the second step is to demonstrate the biologic mechanism that might account for it. In the case of the hypothesis that estrogen causes breast cancer, not only has the association turned out to be weak or nonexistent, but the second step has also been contradicted by various lines of evidence:

1. Birth control pills, which used to contain far more estrogen than HRT does, should increase the risk of breast cancer if estrogen is the culprit. Most published studies find that oral contraceptives do not increase this risk.

2. Women taking estrogen alone do not have a higher risk of breast cancer.

3. The incidence of breast cancer increases as women grow older. If the incidence of breast cancer is due to circulating estrogen levels, this increase should taper off and then decline as a woman reaches menopause, provided she does not take HRT. It does not.

4. Tamoxifen, an "estrogen antagonist," supposedly reduces the chance of recurrent breast cancer by blocking the binding of estrogen to the estrogen receptor on breast cancer cells. Yet when tamoxifen is given to premenopausal women, their natural estrogen levels *increase* up to five-fold. This rise in estrogen should block any competitive binding of tamoxifen, yet tamoxifen's effect against breast cancer works as well in these premenopausal women as in postmenopausal women. Further, laboratory studies have shown that tamoxifen inhibits the stimulatory effects of growth factors involved in breast cancer even in the *absence* of estrogen. In fact, after treatment with tamoxifen, some breast cancer cells actually acquire the ability to proliferate—and low doses of estrogen have been shown capable of killing them. In other words, tamoxifen works in a variety of ways that have nothing to do with its action on estrogen receptors.

In a 2007 NIH conference called "Hormones and Breast Cancer: Etiology vs. Ideology," Dr. Robert Hoover, director of epidemiology and biostatistics at the National Cancer Institute, concluded: "We have reasonable evidence that cumulative lifetime exposure to estrogen is not a risk factor for breast cancer, and, in fact, may not even be true." He added, "part of the appalling nature of hormone carcinogenesis research in general is that we seem to think we know so much based on so little at this point."

The Take-home Message

We have no way of knowing why the investigators associated with the Women's Health Initiative have been so determined and persistent in claiming that HRT is dangerous for most women. For us, the weight of the evidence is clear: women in menopause who have symptoms that seriously affect the quality of their lives should feel secure in taking HRT at the start of menopause and for as many years after as needed to control those symptoms. Any woman worried about her health and longevity should quit smoking before she quits hormones.

Richard Feynman, a Nobel laureate in physics, had a good test for truth in science. He said: "If something is true, really so, if you continue observations and improve the effectiveness of the observations, the effects stand out more obviously. Not less obviously." The relationship between cigarette smoking and lung cancer is an example of the truth becoming clearer with repeated observations. In contrast, the argument that HRT increases the risks of breast cancer and other diseases has still not been reliably demonstrated, despite a vast amount of research, study, and reporting over many decades. □

Note

This is a shorter version of "Hormone Replacement Therapy: Real Dangers and False Alarms," which appeared in *The Cancer Journal*, Volume 15, Number 2, March/April 2009, pp. 93–104. In that article we also discuss HRT's alleged effects on cognitive function, heart disease, menopausal symptoms, and other claims made by the Women's Health Initiative. *The Cancer Journal* paper contains 210 references and a timeline of studies on HRT from 1942 to the present. Interested readers can access the full article free online at http://journals.lww.com/journalppo/Fulltext/2009/04000/Hormone_Replacement_Therapy__Real_Concerns_and.1.aspx.

The authors wish to note that neither has accepted honoraria from the pharmaceutical industry for their research or writing. Tavris has long been a vociferous critic of drug companies' tainting of research. Bluming has received compensation in the past from Wyeth Pharmaceuticals for his time spent as an expert witness. His writings about HRT long antedate this compensation.

Refreshingly Original Excursion over Unmarked Territory

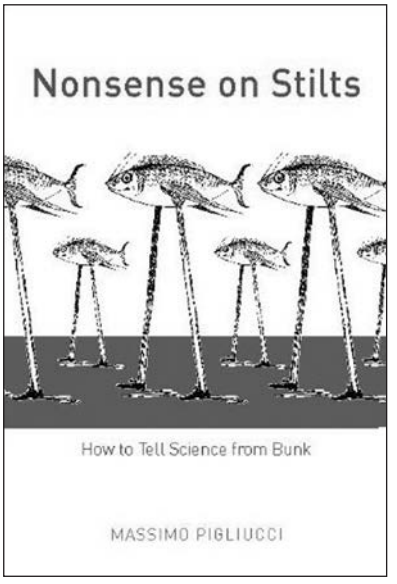
KENDRICK FRAZIER

Nonsense on Stilts: How to Tell Science from Bunk.
By Massimo Pigliucci. University of Chicago Press, 2010. 336 pp. Hardcover, $70; softcover, $20.

Massimo Pigliucci's welcome new book is an especially thoughtful examination of the tumultuous intellectual terrain between science and pseudoscience (or in some cases just nonscience) and how one tells the difference.

Biologist-turned-philosopher Pigliucci (he has doctorates in both fields and, after working for years as a botanist and evolutionary biologist, is now professor of philosophy at the City University of New York–Lehman College) is well known to SI readers as our "Thinking about Science" columnist. Since 2003 he has provided short, well-informed examinations of a variety of theoretical and practical issues in science. He is also coauthor of *Making Sense of Evolution* and author of *Denying Evolution: Creationism, Scientism, and the Nature of Science*.

One stated practical purpose of *Nonsense on Stilts* (a phrase borrowed from philosopher Jeremy Benthem) is to help citizens become better able to make informed decisions about complex issues involving scientific claims. "We have a moral duty to distinguish sense from nonsense," he writes. But I suspect Pigliucci, who clearly has thought deeply about all these issues, wants to raise the level of discussion and show why it is important and relevant to intellectuals and thinkers of all stripes. I think he succeeds in that regard as well.



To me, what makes the book different, in a good and valuable way, from most other book-length explorations of pseudoscience and its distinctions from science is his strong emphasis on philosophy. Everything he discusses is usefully informed by philosophy. He defends this approach effectively: "The methods of scientific and philosophical inquiries can be complementary in debunking pseudoscientific claims. . . . The combined use [of philosophy and science] still represents the most formidable intellectual weapon against nonsense that humanity has ever devised." This approach lends the discussion a high-minded tone and gives it a depth that more straightforward discussions of pseudoscience often lack.

But he quickly gets down to cases, with opening chapters on "Hard Science vs. Soft Science" (where he provides some refreshing defenses of soft science, which after all has to deal with all the messy complexities of life and society rather than simply stated physical principles) and "Almost Science," which leads to thoughtful discussions about string theory, certain interpretations in quantum mechanics, the search for extraterrestrial intelligence, evolutionary psychology, and history. I particularly appreciated his extended discussion of Jared Diamond's work in the history section. (He is more negative about SETI than I think is justified, but he does support his view, which is shared by many.)

Pigliucci provides a valuable mix of general discussion of best approaches for evaluating what is (and is not) science and detailed analysis of specific cases and examples. His strategy is selective. He doesn't attempt to cover everything but rather only certain subjects, and within those he usually chooses just two or three key cases to examine in detail. This is a wise choice. I think it allows him to be original and fruitful.

Often he describes or examines (positively or negatively) specific published papers in some detail; other times, where appropriate, he places more emphasis on the authors themselves. Some topics he examines fairly briefly. Others get entire chapters (e.g., the science and politics of

Kendrick Frazier is editor of the SKEPTICAL INQUIRER.

global warming, including a lengthy analysis of Bjorn Lomborg's *The Skeptical Environmentalist*, with its "whopping 2,930 endnotes—but is it good science?"—and the informed and sophisticated Judge Jones decision against intelligent design).

Typical of his approach—and again what differentiates this book from a number of others that may seek merely to debunk disreputable or unsupported ideas—is where he expresses his purpose in writing about the climate change debate, perhaps a surprising topic for a biologist: "I am here interested not in the global warming controversy per se, but in what it may tell us about the complex intertwining of science, pseudoscience, ideology, and the media." Also here he acknowledges a central point relevant to many of the topics he examines: "We will find that . . . 'controversies' are created in the media that do not really exist in the academy, and that personalities and sound bites count more than thoughtful reflection."

I found the mix of topics he examines (AIDS denialism, UFOs, astrology, cold fusion, paranormality, debates about genetically modified organisms, postmodernism in academia, and the role of the news media—which he argues should do more hard work of investigating claims themselves rather than merely giving a sometimes misleading equal balance of opinions) appropriate and, in some cases, refreshingly surprising. The section on the recent rise of "think tanks" and how they have distorted political debate by emphasizing advocacy of ideological positions rather than dispassionate analysis is one of those nice surprises. Another, late in the book, is a very useful chapter on what actually makes for an expert. "Who's an expert?" is a question you don't hear every day, but it is exceedingly pertinent to many public issues. He begins, not surprisingly, with Plato's Socratic dialogue *Charmide*s but ends very concretely with a valuable five-point guide by Alvin Goldman that a novice can use to determine whether someone is a trustworthy expert.

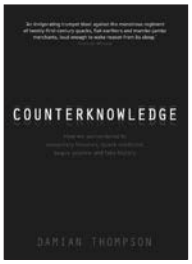
Pigliucci mentions early on that he hopes to provide a nuanced approach to his examinations, and he does that throughout. In fact, it is one of the real strengths of the book. This isn't a simple partisan defense of science against pseudoscience, useful as that can be, but a very thoughtful examination of a huge variety of sometimes very complex issues. Where criticism of science, and even of specific scientists (even honored ones), is merited, he administers the appropriate whacks. (Nobel physicist Steven Weinberg is "ignorant" of philosophy, Stephen Jay Gould's NOMA gave too many breaks to religion, Carl Sagan was hard on his family and soft on SETI, and so on.) He has a delightful chapter forthrightly lambasting some of academia's more egregious postmodernist critics of science (Harry Collins, Paul Feyerband, Leroy White, Ann Taket—he quotes the latter two at length so we can see for ourselves that "I am not making this up. I am not."). But he precedes all that with a chapter usefully warning that sometimes we have trusted science *too much* (and he gives examples of scientists' hubris, self-proclaimed "theories of everything," scientific blunders, eugenics, scientism, etc.).

Yet he never offers just a simplistic and artificial "either-or" balance. His judicious examinations actually come to tentative conclusions and judgments about who is likely right and who isn't. I appreciated his showing us why—and he assesses points—biologist Kenneth Miller is more likely to be right in his defenses of evolution and natural selection than is biochemist Michael Behe in his defenses of intelligent design. The conclusion? "Behe is spectacularly wrong, and Miller is (largely, but not entirely) right." He looks at the notorious Deepak Chopra and finds that there is no way he can be an expert on quantum mysticism for a very different reason than is usually put forth: "There is no such thing as quantum mysticism!"

He follows his final main chapter with "So, what is science, after all?" a concluding valuable summary of the "intellectual journey" on which he has just taken the reader. Here he emphasizes the trinity of naturalism, theory, and empiricism that makes "science different from any other human activity." He again shows why pseudoscience doesn't meet the criteria for science and calls on us to keep our baloney detectors on yellow alert.

"I am here interested not in the global warming controversy per se, but in what it may tell us about the complex intertwining of science, pseudoscience, ideology, and the media."
—Massimo Pigliucci

Pigliucci's approach is thoughtful and intellectual, and he always supports his arguments as one expects a scholar to do. He sees all the shades of gray but isn't shy about pointing out when the facts support black or white judgments. The writing is clear, the case studies abundant, the examples and analogies frequent and clear. *Nonsense on Stilts* is a refreshingly original excursion over the unmarked territory separating science from pseudoscience and nonscience. □



A Lively Attack on Pseudoscience and Pseudohistory

GLENN BRANCH

Counterknowledge. By Damian Thompson. W.W. Norton, New York, 2008. ISBN: 978-0393067699. 176 pp. Hardcover, $21.95.

What is counterknowledge? Damian Thompson never quite offers a clear definition. When the word *counterknowledge* first appears, it is defined as "misinformation packaged to look like fact" (p. 1), but the definition is subsequently refined. Although "packaged" suggests the intention to mislead, purveyors of counterknowledge may know, not know, or be indifferent as to whether they are purveying falsehoods, according to Thompson. He also adds, "Its claims can be shown to be untrue, either because there are facts that contradict them or because there is no evidence to support them" (2). The first part is useful, since it allows that alchemy, for example, wasn't properly counterknowledge until the rise of chemistry. The second part, however, undercuts Thompson's attempt not to stigmatize all religious belief as counterknowledge: when he writes, "If you believe that the Holy Spirit exists, no one can prove you wrong. That is not counterknowledge" (22), he fails to employ the second part. Thompson's practice here is better than his preaching since the second part isn't defensible anyway: a claim for which there is no evidence is not ipso facto untrue.

"We must hold to account the greedy, lazy, and politically correct guardians of intellectual orthodoxy who have turned their backs on the methodology that enables us to distinguish fact from fantasy."
— Damian Thompson

Counterknowledge, like Robert L. Park's voodoo science and Michael Shermer's weird things, is thus not so much a principle for classifying and explaining pseudoscience as it is a catchy phrase that looks nice on the title page. *Counterknowledge*, like *Voodoo Science* and *Why People Believe Weird Things*, is none the worse for not really making serious use of its titular concept. The slender book's subtitle—"How we surrendered to conspiracy theories, quack medicine, bogus science, and fake history"—is a better indication of its contents. After the introductory chapter outlines the concept of counterknowledge, Thompson considers, in successive chapters, creationism in its familiar Christian forms and its burgeoning Islamic variant; pseudohistory as represented by such popular works as Dan Brown's *The Da Vinci Code*, Graham Hancock's *Fingerprints of the Gods*, Gavin Menzies's *1421: The Year China Discovered the World*, and Molefi Kete Asante's *The History of Africa*; and quack medicine. In his criticisms of the forms of counterknowledge under consideration, Thompson relies for the most part on sources that will be generally familiar to readers of skeptical literature; he synthesizes the information competently in a brisk journalistic style.

In the fifth chapter, "The Counterknowledge Industry," Thompson considers the relatively neglected question of how counterknowledge is contrived and marketed, looking at three examples: *The Secret*, the nutrition empire of Patrick Holford, and Menzies's *1421*. Here, in addition to criticizing the counterknowledge claims, Thompson speculates on the causes of their success. *The Secret* is a savvy repackaging of the power of positive thinking in Gnostic garb, limited only by the basic implausibility of the idea. Holford networks effectively with both the "complementary and alternative medicine" crowd and legitimate universities (although Thompson seems to overlook the fact that Holford is no longer involved with the Institute of Optimum Nutrition). The success of *1421*, however, was apparently due only to a good public relations agency, which managed to arouse enough interest in the manuscript that a publisher offered £500,000 for the rights. Although the stories themselves are fascinating, it is hard to detect any general lesson. There is a minor irony in Thompson's beginning the chapter by invoking *The Tipping Point*, whose author, Malcolm Gladwell, is accurately described by Salon.com's Louis Bayard as "building castles of pseudoscience in the quicksand of anecdote."

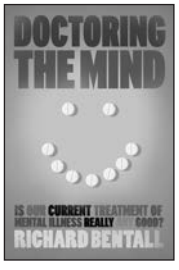
In the final chapter of *Counter-*

Glenn Branch is deputy director of the National Center for Science Education. With Eugenie C. Scott, he coauthored "The Latest Face of Creationism" for the January 2009 issue of Scientific American.

knowledge, Thompson turns his attention to the question of why counterknowledge flourishes. Skeptical of Shermer's appeal to psychological reasons, he takes a sociological approach instead—not surprisingly, since he earned a PhD in the sociology of religion from the London School of Economics, and two of his previous books, *The End of Time* and *Waiting for Antichrist*, are in that field. Modernity and the marketplace are the culprits, he suggests: the dismantling of traditional sources of authority removes the obstacles to accepting counterknowledge, and the commodification of information means that journalistic and scholarly standards are ignored in the pursuit of profit. Adding to the problem is technology: the Internet is a fertile and febrile source of nonsense, although as he acknowledges, it is also a valuable venue for debunkers. Having offered his diagnosis, Thompson declaims (with a reference to Goya's famous etching), "We must hold to account the greedy, lazy, and politically correct guardians of intellectual orthodoxy who have turned their backs on the methodology that enables us to distinguish fact from fantasy. It will be their fault if the sleep of reason brings forth monsters" (138–139). However, he presents no plan of action.

So what is the verdict on *Counterknowledge*? It is, as it aspires to be, a vigorous, impassioned, and lively attack on pseudoscience and pseudohistory, and it would make a nice introduction to or refresher on these topics. Even those with a more than casual interest in pseudoscience and pseudohistory will find something of interest, especially because of the British perspective. For example, although American readers will be acquainted with creationism in its familiar Christian forms and its deleterious effects on the integrity of science education in the United States, they may be shocked to learn from *Counterknowledge* that "Islamic Creationism is turning into a serious problem for British sixth-form colleges and universities" (40).

Although the general level of accuracy is reasonably high, in synthesizing such a mass of information in such a small compass Thompson occasionally commits errors of fact or emphasis, and it would be wise not to rely on the book's detailed claims uncritically. (The notes and a list of further reading are valuable supplements.) It is also disappointing, if understandable, that the discussion of the sociology of counterknowledge is so cursory and limited; we might hope that Thompson will return to the subject and attempt to do it justice. □



Psychiatry and Clinical Psychology: Problems and Prospects

PETER LAMAL

Doctoring the Mind: Is Our Current Treatment of Mental Illness Really Any Good? By Richard P. Bentall, New York University Press, New York, 2009. ISBN: 978-0-8147-9148-6. 364 pp. Hardcover, $29.95.

Psychiatry and clinical psychology are significantly different enterprises characterized by different focuses and methods. Richard Bentall, who describes and critiques these enterprises, is a professor of clinical psychology at the University of Bangor in Wales. He is known for his research into the causes and treatment of severe mental illness and is the author of the award-winning book *Madness Explained: Psychosis and Human Nature.*

Peter Lamal is an emeritus professor of psychology at the University of North Carolina–Charlotte and a fellow of the American Psychological Association's Division of Behavior Analysis.

The first section of his new book *Doctoring the Mind: Is Our Current Treatment of Mental Illness Really Any Good?* addresses the question of whether the impact of psychiatry on society has been positive. Bentall explores three sets of evidence regarding the question. One set concerns whether any advances in psychiatry's treatment of mental illness have been more effective for today's patients than patients in the past. Bentall concludes that the evidence does not support the notion that advances in psychiatric care have resulted in improved mental health in developed countries.

Is there evidence that psychotic patients living in developed countries with well-supported psychiatric services fare better than those with psychotic symptoms who live in countries without comprehensive and widely available psychiatric services? The evidence is that people in developing countries who have severe mental illness are much more likely to recover than are patients in countries that support psychiatric services.

The third source of evidence about the effect of medical psychiatry is what happens to patients when conventional (i.e., drug-dispensing) psychiatric services are suspended. Bentall describes such an experiment that demonstrated that many people with severe mental illness do at least as well with significantly reduced conventional psychiatric treatment.

Bentall concludes that at least with respect to the treatment of psychotic disorders, and contrary to the assumption made by many supposedly well-

informed observers, "Psychiatry is not working" (p. 24).

The second section of the book describes "Three Myths about Mental Illness" (readers may also be interested in Lilienfeld et al., *50 Great Myths of Popular Psychology*). One myth is that psychological diagnoses are meaningful, that psychiatric disorders can be assigned to a discrete number of diseases like those used in physical medicine. This practice has critically important results for the psychiatrist, the patient, researchers, governments, and pharmaceutical companies. It is important to note that these diagnostic categories were not discovered—they were invented. One result is the poor reliability of psychiatric diagnoses; psychiatrists often disagree about the correct diagnosis of patients' problems. Furthermore, the ability of diagnoses to predict patients' responses to treatment is unimpressive. Interestingly, it appears that Bentall and Lillienfeld et al. disagree about this topic because the latter say that "for most major mental disorders (such as schizophrenia and major depression), reliabilities are comparable with those of major medical disorders" (205).

A second myth is "The Fundamental Error of Psychiatry: The Myth that Psychiatric Disorders are Genetic Disorders." For example, the vast majority of schizophrenic patients do not have parents, siblings, or children who are diagnosed schizophrenic. And Bentall describes other problems with the use of data that supposedly favor an overwhelming role of genetics in psychosis. "Since the very earliest days of professional psychiatry, researchers have systematically exaggerated the extent to which serious mental illness is caused by genes, and underestimated the importance of environmental influence" (143).

The positive effects of psychotherapy are real but apparently modest. A very important factor seems to be the quality of the "therapeutic alliance," the relationship between therapist and patient.

A third myth is that "Mental Illnesses are Brain Diseases." The brain is difficult to study and it is not sufficient to demonstrate, for example, that the brains of patients are different from the brains of ordinary individuals. Furthermore, a critical problem with such studies is that they have neglected to take into account the patients' life experiences, and environmental factors could be the cause of observed brain differences.

The book's third section is devoted to the extensive use of psychiatric drugs. The first part emphasizes our need to understand randomized controlled trial (RCT) research studies. This understanding is important because RCTs are the method for determining if drugs are effective. The pharmaceutical companies have huge stakes in the design and results of RCT studies, and Bentall describes consequences of this. One important result is that comparisons of pharmacy-funded and independently sponsored RCT studies have consistently indicated that the pharmacy-funded studies are much more likely to report results favoring drugs they want to get on the market. But the drug companies often decide whether and in what form the data from their RCT studies will be made publicly available.

After considering the costs and benefits of antipsychotic drugs, Bentall concludes that "less is probably better." There is no doubt about the short-term benefits of antipsychotic drugs, at least for some problems. After taking such a drug for the first time, many patients quickly experience relief from their hallucinations and delusions. But providers escalate doses in some cases, and side effects even in the absence of overdoses can be serious and health-threatening. According to Bentall, "*all* antipsychotics have alarming side effects" (222). And perhaps one-third of psychotic patients obtain little or no long-term benefit from antipsychotics.

Can psychotherapy be an effective alternative to psychiatrics? Yes, but inflated claims should not be made; more research needs to be done. The positive effects of psychotherapy are real but apparently modest. A very important factor seems to be the quality of the "therapeutic alliance," the relationship between therapist and patient.

The bottom line: psychiatrists need to reduce their reliance on drugs and spend more time with their patients trying to build a therapeutic alliance. Clinical psychologists need to conduct well-designed studies to determine which of their myriad approaches work best.

Doctoring the Mind is thickly packed with information and includes extensive citation of the relevant literature. It also includes real-life examples, some from Bentall's practice, to illustrate many of his points. □

History and High-Strangeness Speculation

ROBERT SHEAFFER

Contactees: A History of Alien-Human Interaction. By Nick Redfern, The Career Press, Franklin Lakes, New Jersey, 2010. ISBN: 978-1-6016-3096-4. 248 pp. Softcover, $15.99.

"We are not alone . . . and Nick Redfern can prove it." Or so says the publisher's blurb on the back cover of his new book *Contactees: A History of Alien-Human Interaction*. Sure, if "stories" were the same as "proof" or if wishes were fishes. But I'm wondering if the blurb writer actually read the book, since Redfern offers plenty of odd speculations, but nowhere does he claim to have actual "proof."

Actually, this is a better book than it first appears. The first two-thirds of the book is a fairly sober historical account of UFOlogy's once-glorious "contactees," like George Adamski and George Van Tassel, who achieved great fame by claiming to have an ongoing friendship with wise and kind visitors from another world. This is in contrast with UFOlogy's celebrated "abductees" of more recent times, who were dragged onto flying saucers against their wills and subjected to insensitive medical-like procedures by unfeeling, expressionless Little Gray Men. In both cases, however, the aliens typically end up dispensing "wisdom" about the terrible problems facing humanity and planet Earth, usually expressed in the form of amazingly simplistic platitudes. Another strange fact, noted by Redfern: the contactees were overwhelmingly male. But we also know that UFO abductees were, and are, overwhelmingly female. So what does this mean? Where is Dr. Freud when you need him?

Redfern tells the histories of all of the UFO contactees that I'd ever heard of, as well as several that I hadn't. Daniel Fry, Truman Bethurum (who had a space lover named Captain Aura Rhanes of the planet Clarion), Orfeo Angelucci, George King of the U.K., Wayne Aho, Reinhold Schmidt, Herb Schirmer, Billy Meier of Switzerland—they're all here. So far as I can tell, all of the contactee-related history he gives us is accurate. If you're looking for a rollicking read of high-strangeness saucer claims, you'll find it here.

But mixed into the historical narrative are the high-strangeness speculations of Redfern and some of his pals, suggesting that the contactee phenomenon involves something mysterious, instead of the obvious conclusion: guys were seeking attention by making up wild stories. Redfern is sophisticated enough to realize that the absurd stories told by contactees cannot possibly be true in a literal sense, so he suggests that "like most of the contactees, Adam was fed an absolute barrage of pseudo-scientific nonsense." This is about a mysterious contactee known only as "Adam," written about by the well-known contactee Orfeo Angelucci. Adam is said to have "mysteriously vanished into the night" (pp. 66–67). Employing classic Saucer Logic, Redfern suggests that the strange visitors might exist but are habitual liars who keep feeding their human contacts obviously bogus information for unknown reasons. My suggestion is much simpler: "Adam," the Space People, and the barrage of pseudoscientific nonsense all sprung from the fertile imagination of Angelucci, without help from anyone on this planet or any other.

We now know that there was an FBI file on the late UFO skeptic Philip J. Klass, as well as on many celebrities and political activists, so it seems that there was an FBI file on everyone who was anyone.

I am at a loss to understand Redfern's obsession with the so-called Brown Mountain Lights (or "ghost lights") of North Carolina. The phenomenon has been investigated many times, going back to at least 1913, and shown to be conventional lights such as automobile or locomotive headlamps. He repeats the

Robert Sheaffer's "Psychic Vibrations" column in SI regularly examines UFO-related claims. He is author of UFO Sightings: The Evidence.

claim that "during the period in which the trains were out of action, the mysterious lights were still regularly seen." He seems unaware that the 1923 Geological Survey investigation by George R. Mansfield states, "During the flood of 1916, when train service was temporarily discontinued. . . . Automobiles were then in use in the larger towns and on some of the intervening roads, and their headlights were doubtless visible from Loven's [Hotel] over Brown Mountain."

Redfern also notes, in my opinion correctly, the resemblances between the contactee phenomenon and religious claims of encounters with unworldly beings, such as those of Joseph Smith. Is this evidence of some very strange phenomenon at work or instead an illustration of the curious mental processes of that very strange creature known as *Homo sapiens*?

Admittedly, some pretty strange facts do turn up along the way. The FBI took an interest in several contactees, including Adamski and Van Tassel. But in the context of 1950s Cold War fears of Communist propaganda and subversion, this is not surprising. We now know that there was an FBI file on the late UFO skeptic Philip J. Klass, as well as on many celebrities and political activists, so it seems that there was an FBI file on everyone who was anyone. The CIA likewise is seen to have been interested in claims of communications with extraterrestrials. But the CIA is also known to have sponsored research on "remote viewing" at SRI International and elsewhere, and we know that the attempt to create "psychic warriors" as depicted in *The Men Who Stare at Goats* is not entirely fiction. Do we conclude that some great mystery must exist since the CIA is investigating or that some CIA officials are excessively gullible concerning claims of this kind? Nick Redfern and I would probably reach different conclusions, but I enjoyed reading his book nonetheless. □

Putting Public Panics in Perspective

BENJAMIN RADFORD

Outbreak! The Encyclopedia of Extraordinary Social Behaviors. By Hilary Evans and Robert Bartholomew. Anomalist Books, New York, 2010. ISBN: 1-933665-25-4. Softcover, $39.95.

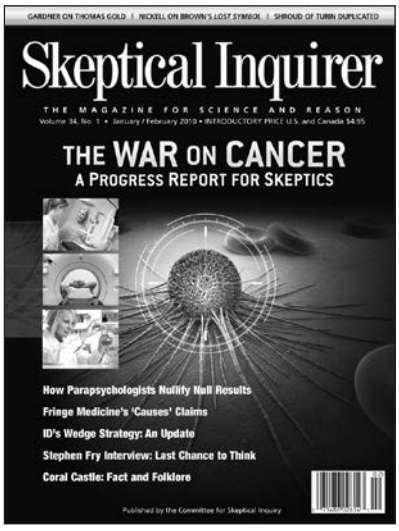
Incidences of mass hysteria and collective social delusion are of particular interest to skeptics, for they illustrate how groups of people can fervently believe in—and be affected by—things that don't seem to exist outside of their collective imaginations. If one person reports an unusual experience (say, being abducted by aliens) without offering evidence for it, it might be chalked up to hoax or hallucination. However, if dozens or hundreds of people report experiencing a phenomenon for which science can find no plausible cause, we must often look to sociology for an explanation.

The subject of mass delusions has received little academic attention compared to most other sociological phenomena, and thus the new encyclopedia *Outbreak!* by Hilary Evans and Robert Bartholomew fills a much-needed gap in the literature, following in the tradition of Charles Mackay's classic 1841 text *Extraordinary Popular Delusions and the Madness of Crowds*. The scope of this eight-hundred-page book is broad, covering nearly 350 entries on a wide variety of topics, including benign fads and crazes (i.e., the Hula-hoop), wartime panics, UFO flaps, phantom attackers (such as the Phantom Gasser of Mattoon or India's Monkey Man panic), witchcraft accusations, school outbreaks, suicide clusters, alien abductions, doomsday cults, satanic abuse panics, disease pandemics, and many more. Even longtime SKEPTICAL INQUIRER readers will be unfamiliar with many of the subjects. Each page reveals fascinating, little-known incidents of bizarre collective beliefs and behaviors, as well as new facts and twists on well-known cases.

Each page reveals fascinating, little-known incidents of bizarre collective beliefs and behaviors, as well as new facts and twists on well-known cases.

The authors take a careful, objective look at each topic and approach the subject with the knowledge that whether or not a particular behavior represents a social delusion depends largely on the context and beliefs of the affected people. Not every incident in the encyclopedia is necessarily evidence of psychological disorder or mass hysteria, but all of them are in some way examples of extraordinary social behavior. The book avoids psychological and sociological jargon, making it accessible to the casual reader but scholarly enough for the serious researcher. Each section concludes with dozens (or hundreds) of sources and references, and most entries are cross-referenced. *Outbreak!* is the most comprehensive book of its kind, invaluable to any skeptic interested in mass hysteria and collective delusions. □

Benjamin Radford is a CSI research fellow and the managing editor of the SKEPTICAL INQUIRER.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Published by the Committee for Skeptical Inquiry

The War on Cancer: A Skeptic's View

I was very impressed that you published Dr. Reynold Spector's honest report "The War on Cancer: A Progress Report for Skeptics" (SI, January/February 2010). Dr. Spector provided an accurate review of the scientific literature to date on the diagnosis and treatment of people with cancer. It was a pleasure to see an article in your magazine using the skeptics' viewpoint in its analysis of conventional medical treatments. Ultimately, Spector acknowledges what many other physicians and medical journalists have discovered, which is that there is "very little overall progress in the war on cancer."

Not only does he question many conventional cancer treatments, but he also questions their high cost and quite minor benefits. Spector goes further by discussing some of the risks and benefits of various cancer screening procedures, many of which he acknowledges provide many false-positive results in order to find a very small number of true-positives.

Despite this impressive critique, you then chose to publish Dr. Fa-Chyi Lee's "An Oncologist's View from the Trenches." Dr. Lee simply provides individual case histories in which his conventional medical treatment provided some benefits for select patients. I could not help but laugh at the decision to publish the doctor's series of anecdotal reports when you never do so after publishing a similar critique of the many unconventional treatments. Can or should we expect a change in your magazine's appreciation for anecdotal reports, or are such cases only considered valid when discussing conventional medical treatments?

Dana Ullman
Berkeley, California

(Dr. Lee's invited sidebar comment gave a very human side of the cancer story from an oncologist who treats cancer patients every day. It seems to me this was useful in rounding out the statistically based picture. He didn't disagree with Dr. Spector's overall point.—Ed.)

In his article "The War on Cancer," Dr. Spector discusses several causes of bias but does not mention competing death bias. It is an unfortunate fact that everyone must die. Since the death rate has to equal 100 percent over a long enough period, any decline in a specific cause of death must cause an increase in others. We have made great strides in preventing deaths from cardiovascular disease and stroke, so an increase in cancer would be expected. That cancer deaths have declined at all represents a hidden improvement in prevention and treatment.

Elizabeth Gordon
Decatur, Georgia

In "The War on Cancer," Dr. Reynold Spector said we don't know the mechanism by which smoking causes cancer. That's not true. We have long known that the mechanism is the polonium-210 in cigarette tobacco that is inhaled and deposited in the lungs, actively radiating internal organs of the host, decaying into lead-206 in less than a year (which is also a known poison and carcinogen; see www.cancer.org/docroot/PED/content/PED_1_3X_Lead.asp).

Polonium-210 is one of the deadliest naturally occurring radioactive isotopes, 250 million times more toxic than cyanide, five thousand times more radioactive than radium. Yet smokers repeatedly inhale it directly into their lungs, where it concentrates at certain nodes and continually radiates the interior of the lung. Then it becomes toxic lead. For a regular smoker the net exposure produced is well over five times average natural background radiation, equivalent to more than three hundred chest x-rays a year. Given that the causal link between radiation and cancer is very well established, and the depositing of an extremely radioactive isotope in the lungs of smokers has likewise been established in multiple peer reviewed studies, there cannot be any reasonable doubt by what mechanism smoking causes lung cancer.

The mantra "we don't know how smoking causes cancer" is entirely a marketing product of the industry, designed to dissuade researchers like Spector from actually checking the journals more extensively, which have been documenting evidence of this causal mechanism since the 1960s.

But the fact that we do know the causal mechanism does support Spector's overall point: the number one action item in our war against cancer should be to end smoking. Indeed, as this radioactive content has been demonstrated to be present in cigarette smoke, passive exposure to that smoke must also deposit radioactive isotopes in the lungs of nonsmokers and thus must necessarily be responsible for even more cancers than befall smokers.

For a complete survey of the evidence and science establishing every aspect of polonium exposure in smokers (and the industry's very effective efforts at suppressing this information), read Brianna Rego's "The Polonium Brief: A Hidden History of Cancer, Radiation, and the Tobacco Industry," *Isis* 100 (September 2009): 453–84.

Richard C. Carrier
www.richardcarrier.info

I very much enjoyed reading the "War on Cancer" article, and as someone who has previously conducted research in the area there was much to agree with.

However, I note a rather unfortunate error in the section "Where Should We Go from Here?" The author asserts that "even though we know cancer of the lung is caused by cigarette smoking, we do not know the mechanism." This is actually one of the few cases in which we do have a good idea of at least one of the mechanisms of carcinogenesis. Please see: Park et al. 2008. Evidence for the aldo-keto reductase pathway of polycyclic aromatic trans-dihydrodiol activation in human lung A549 cells. *PNAS*. Available online at www.pnas.org/content/105/19/6846.full.pdf.

David C. Briggs
Structural Biologist
University of Manchester
david.c.briggs@manchester.ac.uk

In the article "War on Cancer," Spector noted an increase of prostate cancer in the mid-1990s. Is it possible that the increase was caused by Vietnam veterans approaching age

sixty? Among Vietnam vets there seems to be an epidemic of prostate cancer, and the VA has belatedly acknowledged it was caused by exposure to Agent Orange.

Robert Oliver
Nixa, Missouri

Dr. Reynold Spector responds:

To Gordon: Although the cancer death rates have declined slightly, as pointed out in the article there are now 200,000 more cancer deaths per year in the U.S. since 1975 due to the increase in population. The point remains that the War on Cancer has not gone well.

To Carrier and Briggs: For many years I worked summers as a radiochemist and am into isotopes in a big way. Carrier is raising an old hypothesis with data mainly from the 1960s and 1970s. On the last page of the article that Carrier cites, author Brianna Rego writes, "It is impossible to know how many of these [lung] cancers were caused by alpha-emitting isotopes (like polonium) in tobacco." Thus Carrier's reference does not back up his categorical statement. The "cause" of lung cancer in cigarette smoke is now believed to be due to polycyclic aromatic hydrocarbons and nitrosoamines in the smoke. Polonium may be a minor player, but no one knows. I stand by my statement that smoking "causes" lung cancer, but the mechanism remains uncertain.

To Oliver: I do not have access to definitive data on Agent Orange and prostate cancer, so I cannot comment on any putative association.

Meta-analysis of ESP Ganzfeld Studies

In the January/February 2010 issue of SI, Richard Wiseman ("'Heads I Win, Tails You Lose': How Parapsychologists Nullify Null Results") discusses a meta-analysis I conducted showing that ESP ganzfeld studies following the "standard" procedure collectively yielded strong positive results. The studies were blind-rated for standardness by psychology graduate students. Wiseman claimed that I forced the raters to define the testing of participants with particular psychological characteristics as standard because these studies produced significant psi results—or, as he put it, "decide[d] which studies to analyze (or in this instance, the weight assigned to them) on the basis of their known outcome"—to help justify a spurious claim of support for the psi hypothesis. This would reflect dishonesty or extreme incompetence on my part (and that of my coauthors for signing off on it), so it's serious business. The reasons for the stipulation are not as Wiseman claims; his allegation is baseless and false.

It is odd that Wiseman cited a passage from my instructions to the raters in which I justified the procedure with reference to the results from an *earlier* set of studies, the "PRL experiments" (Bem and Honorton 1994). Given the context, the implication is that I lied to the participants about the purpose of my stipulation. Wiseman could not credibly claim that this is the justification he meant to criticize because his sentence quoted above is unambiguous.

Wiseman also irresponsibly failed to cite other justifications for the stipulation. One was stated in Bem et al. (2001): "[the participant variables] were explicitly identified elsewhere in Bem and Honorton (1994, p. 13) as potentially psi-conducive based on the previous meta-analyses" (p. 215).

Another justification, which did not involve psi results at all, was published in an earlier version of our report (Palmer and Broughton 2000). Wiseman should have consulted this version, cited in Bem et al. (2001), before making such a serious allegation. The mega-criterion for standardness in my meta-analysis was conformity to the procedures adopted in the PRL experiments. Because the experiments I analyzed were treated by both sides as attempted replications of the PRL experiments, this decision is reasonable. The stipulation about participant characteristics is also reasonable because some of the PRL experiments used samples with those same characteristics. For example, as it turned out, the percentage of standard studies in my meta-analysis that tested artistic/creative participants (the main bone of contention) was 10 percent (3 of 29), which is virtually identical to the percentage in the PRL experiments (9 percent: 1 of 11). Such uniformity of samples is the ideal for a valid replication. Had I not made my stipulation, I could legitimately have been accused of biasing the analysis against the psi hypothesis.

Finally, with regard to "cherry-picking," Wiseman was derelict in not noting that the great majority of psi meta-analyses included standard file-drawer analyses and that these analyses have consistently shown that a ridiculously large number of unpublished null studies must be assumed to reduce the collective p-value to nonsignificance.

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John Palmer
Editor, *Journal of Parapsychology*
Rhine Research Center
Durham, North Carolina

Richard Wiseman responds:

Palmer believes that my article accuses him of dishonesty or extreme incompetence. I do not accept that the article makes such a claim and have no reason to doubt Palmer's honesty or competence. Researchers conducting meta-analyses are required to make decisions about which studies are to be included and how they will be analyzed. Such decisions are sometimes made by people who are aware of study outcome within the area under scrutiny, thus raising the possibility that decisions regarding selection criteria could be influenced by that knowledge. This kind of influence is routinely recognized by methodologists and indeed is the reason why, in medical research, institutions such as the Cochrane Collaboration encourage the use of prospective meta-analysis to avoid these issues when conducting systematic reviews. I believe that it was wrong for Palmer and colleagues to define a "standard" ganzfeld experiment as one involving artistic or creative participants. That idea does not appear in the method sections of the ganzfeld reports that they gave to their raters, and only one of the eleven studies described in these reports involved creative participants. It is not a question of them being dishonest or incompetent but rather biased.

Wedge Strategy Victim: How to Help?

Is there a support group of some sort to support Christina Comer in her lawsuit against dismissal from her job by the Texas Education Agency ("Wedge Strategy Update," SI, January/February 2010)? Not only is it an injustice done to her personally, it has a big implication of letting the "wedge" of teach-

ing "intelligent design" in the science classroom hold a firmer footing in Texas schools. We have to support her and help her fight all the way to the Supreme Court, if it will go that far.

I am alarmed by the persistent efforts and changing tactics of the ID movement and its like despite its numerous losses in the courts. I hope Ms. Comer does not think that she is alone in fighting this battle. With the ruling for the TEA and her appeal of the dismissal, it has been and will be a long battle. Even a letter of support and encouragement, let alone other material support, will go a long way. I would like to learn more about how to help/support Ms. Comer's case and to have continued updates from SI.

Mio Sam Lao
Princeton, New Jersey

Barbara Forrest responds:

The National Center for Science Education's Web page on the Comer case, http://ncse.com/creationism/legal/chris-comer-docs, is the best place for updates. Basically, appellate briefs have been submitted but nothing new has happened since November 2009. To help, our suggestion is that you contact and support Texas groups that have been fighting for the integrity of science education there, such as Texas Citizens for Science and the Texas Freedom Network, as well as NCSE.

Nonbiological Oil: Whose Idea Was It?

Martin Gardner's column "Thomas Gold: Is the Origin of Oil Nonbiological?" (SI, January/February 2010) seems to support Freeman Dyson's opinion in his foreword to Thomas Gold's book *The Deep Hot Biosphere* (1999) that Thomas Gold was the originator of the hypothesis that oil has a nonbiological origin. Perhaps unknown to Martin is a Web site by J.F. Kenney that documents the fact that Russian and Ukrainian geologists and geochemists are the originators of this idea and that Thomas Gold plagiarized it, claiming that it was his idea without giving credit to its proper sources (see www.gasresources.net).

The "Introduction" to this Web site lists many articles explaining the situation in which Gold managed to carry out his plagiarism. Also included are several articles describing the thermodynamics that indicate that oil (petroleum) can be formed at temperatures and pressures found only at depths of more than 100 kilometers and cannot be formed from dead plants and animals. The current models for hunting for oil in geologic traps and source rocks are misguided. Using the nonbiological model for the origin of oil, Russian and Ukrainian geologists are finding huge amounts of oil in microfractured and porous granitic rocks below the sedimentary rocks in which most U.S. geologists currently look for oil.

Lorence Collins
Retired Professor of Geology
California State University, Northridge

The article by Martin Gardner on Thomas Gold got me wondering. If according to the theory abiotic oil formed on Earth, then why not the Moon? It has a similar origin, composition, and impact history. Has NASA or the European Space Agency detected evidence of lunar gushers after a moonquake?

John Lockard
Johnson City, Tennessee

(Not that we've heard of.—Ed.)

Challenging Scientific Orthodoxy

It is ironic that in the same issue (SI, January/February 2010) where Stuart Jordan lambastes advocates who question man-made warming ("bogus claims" based on "utter nonsense") SI also profiles Thomas Gold, a scientist who challenged scientific orthodoxy and was "viciously attacked" for ideas thought, at the time, "nonsense," yet were later proven true.

History is replete with examples of established academics circling the wagons against outsiders to protect their theories, reputations, and livelihoods (one example given, plate tectonics, was called crazy by old school geologists).

While Jordan claims that the *best* (his italics) climate models predicted the decline in temperatures, he ignores that many predictions made by warming advocates for more storms, more melting, and increased warming were mostly wrong.

Chris Michiels
Los Angeles, California

Who Has Climate Credibility?

In the January/February 2010 SI, Robert Sheaffer and Gary Posner question the CFI "Credibility Project" assessing the credentials of the 687 "dissenting scientists" who signed Sen. James Inhofe's minority report on climate change, by asking for a similar assessment of IPCC scientists.

The information necessary for such an assessment may be found online. Jim Prall's "Most-Cited Authors on Climate Science" Web page (www.eecg.utoronto.ca/~prall/climate/) allows you to compare the credentials and citation records of the 619 IPCC AR4 working group 1 (climate science) authors to those of signatories of various public declarations on climate change, pro and con.

This information supports the conclusions of the CFI "Credibility Project"—there are very few legitimately credentialed climate change skeptics. Further, many of those identified as skeptics who are legitimately credentialed accept that there is anthropogenic global warming, though they question its extent and impact. I recently asked Robert Balling of Arizona State University, who appears on climate skeptic lists, where I as a layman could find the best consensus information about climate science. His answer: in the IPCC AR4 physical science report.

It should also be noted that climate skeptic John R. Christy was an IPCC AR4 wg1 lead scientist.

It's no surprise that there are numerous scientific organizations that have officially endorsed the IPCC's position on anthropogenic global warming, including the national academies of many countries, and none that have rejected it.

Jim Lippard
Phoenix, Arizona

Rigid Walls between Sciences

Like Massimo Pigliucci ("Is There a Difference Between Basic and Applied Research?" SI, January/February 2010), I have "made a career of walking the line between disciplines," and like him I deplore the existence of such boundaries. As a nuclear chemist, I have walked the line between physics and chemistry for many years. Recently, I was a victim of the ignorance and

narrow-mindedness that can stem from the perceived rigidity of that line.

As a columnist for the weekly magazine of a national chemistry organization, I wrote a column pointing out that, just as there are mass-energy conversions in nuclear reactions—that's where the energy of fission and fusion comes from: the conversion of mass into energy according to Einstein's $E = mc^2$—there are also mass-energy conversions in chemical reactions, although they are more than ten orders of magnitude smaller. In both cases, the mass changes come from changes in the bond, or binding, energies within the molecules or nuclei.

By way of comparison, the energy released by a one-megaton nuclear fission bomb comes from the loss of about forty grams of mass. The loss of mass in the chemical reaction between hydrogen and oxygen gases to form water is 2×10^{-9} grams per mole, a virtually undetectable amount of mass change, even in this explosive, energy-releasing chemical reaction. No wonder chemists can do their work as if mass were conserved absolutely in chemical reactions.

When I submitted my column to the magazine's editors, they exploded so violently that they surely must have lost ten pounds, at least.

"You're wrong! You're wrong!" they shouted over the telephone, "*That's physics!*"

This bizarre retort was followed by what one of them apparently believed to be the ultimate test of absolute truth: "I asked a physicist, and he said you're wrong!"

Against the editors' hysteria I could not squeeze in a word to point out that nature does not operate by different rules for different university science departments and that Einstein never said "$E = mc^2$ except in chemistry."

As a result, my column-writing contract with the magazine was summarily terminated.

By the way, I submitted a brief commentary on mass-energy conversion in chemical reactions to the prestigious journal *Nature Chemistry*, and it was rejected on grounds that it was nothing new and that, in effect, "everybody already knows that."

Except, evidently, two editors of that other chemistry magazine.

Is there a message here for skeptics? Yes. When presented with something you don't believe, ask questions. Casting out the messenger will never reveal the truth.

Robert L. Wolke
Professor Emeritus of Chemistry
University of Pittsburgh

(Wolke is author of What Einstein Told His Barber: More Scientific Answers to Everyday Questions *and other popular books.—Ed.)*

I am surprised that Dr. Pigliucci did not mention Donald Stokes's book *Pasteur's Quadrant*. Its idea is that basic and applied approaches to research are not necessarily opposed. Stokes plots "basicness" (*y* axis) versus "appliedness" (x axis). In his examples, Bohr's work is fully basic, and Edison's work is fully applied. Pasteur was high in both categories, so he shows up on the upper right-hand corner of the plot. Wikipedia has a sketch available online at http://en.wikipedia.org/wiki/Pasteur%27s_Quadrant.

John Dooley
Department of Physics
Millersville University
Millersville, Pennsylvania

Massimo Pigliucci responds to Dooley:

Right, but my argument is not that they are opposed, just that they are more independent than most people seem to think.

Psychiatry's 'True Cause'?

Regarding Hall's "The One True Cause of All Disease" (SI, January/February 2010): To quote, "When you go to a doctor with a fever, does he just treat the symptom? No, he tries to figure out what's causing the fever. If it's pneumonia, he identifies which microbe is responsible and gives you the right drugs to treat that particular infection. . . ."

Dr. Hall might well clarify the meaning of the term "doctor." Assuming that she means an MD or OD, then it would also seem prudent to look into the practice of her psychiatric colleagues, very few of whom I've known ever search for the microbe underlying the cause of their patient's symptoms, although a few will use a "by exclusion" process. When pressed, many will invoke the "one true cause," chemical imbalance.

Given Dr. Hall's criteria, it would seem appropriate to classify psychiatry as an alternative medicine.

Randall Martin
DeKalb, Illinois

Hyperbaric Therapy

Benjamin Radford's column on Hyperbaric Therapy (SI, January/February 2010) missed a couple of points.

High pressure oxygen is extremely toxic—hardly a harmless treatment. The partial pressure of oxygen is typically reduced in hyperbaric chambers when treating the "bends," and an inert gas is used to increase the overall pressure. The bends are not "related to oxygen in the blood." The condition is caused by an overall excess of dissolved gasses (mostly nitrogen) coming out of solution and forming bubbles in the bloodstream as pressure is reduced (divers returning to the surface or high altitude flight) and is treated by increasing the pressure to redissolve the gas in the blood, then slowly reducing the pressure to normal to allow the gasses to escape without forming bubbles.

High oxygen pressures in a hyperbaric chamber are used to treat gangrene—specifically to assist in getting oxygen to damaged tissues with poor blood circulation to prevent further tissue death; and in CO poisoning—to both slowly purge the carbon monoxide from blood hemoglobin and to make sure remaining unpoisoned red blood cells get as much oxygen as possible. Technically, neither condition is related to "oxygen in the blood," and the time under high pressure oxygen is strictly controlled to avoid oxygen poisoning.

Basic errors like these cast serious doubt on the scientific competence of the Autism Science Foundation.

John Jogerst
JJogerst@aol.com

Pseudo Scientific?

Regarding "Respected Science Supplier Sells Ghost Gadgets" (SI Extras online, mentioned in January/February 2010 SI), this is not the first time by a long way that Edmund Scientific went pseudo. It must have been in the 1960s–70s when they sold small pyramids to keep your razors sharp and flowers fresh or to improve your wine—you know the sort of claims. I remember someone in Holland asking me in desperation how to align them exactly North-South; at least he did notice the things didn't work as advertised.

Harrie Verstappen
harrie@thelooniverse.com

Maher's Ludicrous Comment

Martin Gardner whitewashes the truth when he suggests ABC cancelled Politically Incorrect

simply because Bill Maher "carelessly remarked" that "the September 11 terrorists were brave men" ("Bill Maher: Crank and Comic," SI, November/December 2009). Maher's infamous comments actually were: "We have been the cowards lobbing cruise missiles from 2,000 miles away. That's cowardly. Staying in the airplane when it hits the building, say what you want about it, it's not cowardly."

Obviously, this was far less a comment about the terrorists' "bravery" than it was a ludicrous and insensitive comment on the men and women of the U.S. military who heroically participated in this country's war on terrorism in the aftermath of 9/11. Contrary to Gardner's suggestion, this is (understandably) what got so many people riled up and prompted ABC to cancel Maher's show.

George Anhang
Washington, DC

A 'Haunting' in Arizona

Recently, as I was shopping at a local store, I saw an object fly off one of the top shelves and land on the floor. The object did not simply drop straight down from the shelf but followed a noticeable trajectory. This seemed odd, so I decided to investigate.

There was no one else in the area that I could see, and nothing else seemed unusual. The object in question was a small toy doll packaged inside of a slick cardboard box. The other merchandise on the top shelf had been jumbled by earlier shoppers, and some of the items seemed ready to slide off. Also, there was a large heating vent above and directly behind the shelf. It was aimed directly at the shelf the doll had fallen from, and it was blowing very hard. While I could not get the box to repeat its earlier flight, possibly because I did not know its exact position before it flew from the shelf, I felt the mystery had been sufficiently explained.

I wonder if this had happened late at night in a darkened store, would it have been interpreted as evidence of a haunting? I placed the toy back on the shelf and walked away, amused at my brush with the perfectly normal.

Stephen D. Harmon,
Mesa, Arizona

Refreshing

Wow! Wow! Wow! I had heard of you folks previously but only just this weekend learned the correct name of your organization to find you on the Web. It is truly refreshing to hear and see the reality of the world, science, and astronomy. It is such a shame that kooks and freaks get more attention than true science. I saw an episode of a History Channel program over the weekend in which I believe Benjamin Radford used very simple investigative techniques to completely debunk a bogus ghost story in California.

Thank you guys for shaming and showing these psycho cases for what they are!

David L. Finchum
Louisville, Tennessee

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THE LAST LAUGH

BENJAMIN RADFORD, Editor

HIDDEN MESSAGES by Dave Thomas

The following letters are a simple substitution cipher. If R stands for L, it will do so everywhere. Solution is by trial and error. Hint: Look for patterns in words; for example, the scrambled phrase "JRXJ JRQ" might represent "THAT THE."

PUZZLE

"R DU DFDREAB CHGRFRPE ZHLDMAH RB

BHDLSHA MA BP ZH ADBRATRHI XRBS EPB

MEIHCABDEIREF BSH XPCGI."

—CRLSDCI IDXWREA

CLUE: T = F

PREVIOUS PUZZLE SOLUTION (#4): "THOSE OF YOU WHO BELIEVE IN TELEKINESIS, RAISE MY HAND." — AMERICAN WRITER KURT VONNEGUT

SUPER-SECRET WORD: GHOSTLIKE

Hidden Messages Puzzle Contest

Submit your solution by e-mail to bradford@centerforinquiry.net or via postal mail to: Benjamin Radford, The Last Laugh, P.O. Box 3016, Corrales, NM 871048. Winner will be chosen at random from the first three correct submissions.

This issue's prize is a copy of the documentary film *The Other Side: Giving Up the Ghost* about the world of ghost hunting. For more on this and other films, visit www.exspirofilms.com.

March/April 2010 Hidden Messages Puzzle contest winner: **Michael Skor**

"So far we've had zero sightings of the ivory-billed woodpecker and six sightings of Elvis."

Reasons Why Creationists Are More Intelligently Designed Than Evolutionists

1. "Creationism" comes before "evolution" in the dictionary.
2. Radiometric dating has determined that Kirk Cameron is between six thousand and ten thousand years old.
3. The banana was obviously perfectly designed by a designer for eating and using in other creative, non-edible ways.
4. There are no transitional species. Where the hell are the flying squirrels, for example?
5. We'd look more like the *Planet of the Apes* chimps if we were evolved from monkeys.
6. Ben Stein offers a perfect example of irreducible complexity "wherein the removal of any one of the parts [such as dying brain cells] causes the system to effectively cease functioning."
7. Especially when filled with animal crackers, my Noah's Ark cookie jar is an exact replica of the real deal as depicted in my illustrated Bible.
8. Evolution violates the second, third, fourth, and any future laws of thermodynamics that science types can dream up.
9. If the earth were actually billions of years old, all the water from the Genesis flood, which currently covers three-fourths of the earth's surface, would have disappeared down the drain by now.
10. After supposedly "millions of years," tetrapods haven't evolved into pentapods.
11. Evolution is only a theory, like the theory of the Scottish origin of rap music.
12. There are well-known, professionally published scientists who believe in God and think dogs can telepathically communicate with humans.
13. Contrary to claims by Darwinists, Ann Coulter is not a transitional fossil.
14. Creationism must be a valid alternative theory—just look at all that crap in the Creation Museum!

Gary Bauslaugh, editor, *Humanist Perspectives*, Victoria, B.C., Canada
Richard E. Berendzen, astronomer, Washington, D.C.
Martin Bridgstock, Senior Lecturer, School of Science, Griffith University, Brisbane, Australia
Richard Busch, magician/mentalist, Pittsburgh, Penn.
Shawn Carlson, Society for Amateur Scientists, East Greenwich, RI
Roger B. Culver, professor of astronomy, Colorado State Univ.
Felix Ares de Blas, professor of computer science, University of Basque, San Sebastian, Spain
Sid Deutsch, engineering consultant, Sarasota, Fla.
J. Dommanget, astronomer, Royale Observatory, Brussels, Belgium
Nahum J. Duker, assistant professor of pathology, Temple University
Taner Edis, Division of Science/Physics Truman State University
Barbara Eisenstadt, psychologist, educator, clinician, East Greenbush, N.Y.
William Evans, professor of communication, Center for Creative Media
Bryan Farha, professor of behavioral studies in education, Oklahoma City Univ.
John F. Fischer, forensic analyst, Orlando, Fla.
Eileen Gambrill, professor of social welfare, University of California at Berkeley
Luis Alfonso Gámez, science journalist, Bilbao, Spain
Sylvio Garattini, director, Mario Negri Pharmacology Institute, Milan, Italy
Laurie Godfrey, anthropologist, University of Massachusetts
Gerald Goldin, mathematician, Rutgers University, New Jersey
Donald Goldsmith, astronomer; president, Interstellar Media
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Terence M. Hines, professor of psychology, Pace University, Pleasantville, N.Y.
Michael Hutchinson, author; SKEPTICAL INQUIRER representative, Europe
Philip A. Ianna, assoc. professor of astronomy, Univ. of Virginia
William Jarvis, professor of health promotion and public health, Loma Linda University, School of Public Health
I.W. Kelly, professor of psychology, University of Saskatchewan
Richard H. Lange, M.D., Mohawk Valley Physician Health Plan, Schenectady, N.Y.
Gerald A. Larue, professor of biblical history and archaeology, University of So. California
William M. London, California State University, Los Angeles
Rebecca Long, nuclear engineer, president of Georgia Council Against Health Fraud, Atlanta, Ga.
Thomas R. McDonough, lecturer in engineering, Caltech, and SETI Coordinator of the Planetary Society
James E. McGaha, astronomer, USAF pilot (ret.)
Chris Mooney, journalist, author, Washington correspondent, *SEED* Magazine
Joel A. Moskowitz, director of medical psychiatry, Calabasas Mental Health Services, Los Angeles
Matthew C. Nisbet, assistant professor, School of Communication, American University
John W. Patterson, professor of materials science and engineering, Iowa State University
James R. Pomerantz, professor of psychology, Rice University
Gary P. Posner, M.D., Tampa, Fla.
Daisie Radner, professor of philosophy, SUNY, Buffalo
Robert H. Romer, professor of physics, Amherst College
Karl Sabbagh, journalist, Richmond, Surrey, England
Robert J. Samp, assistant professor of education and medicine, University of Wisconsin-Madison
Steven D. Schafersman, asst. professor of geology, Miami Univ., Ohio
Chris Scott, statistician, London, England
Stuart D. Scott, Jr., associate professor of anthropology, SUNY, Buffalo
Erwin M. Segal, professor of psychology, SUNY, Buffalo
Carla Selby, anthropologist/archaeologist
Steven N. Shore, professor and chair, Dept. of Physics and Astronomy, Indiana Univ. South Bend
Waclaw Szybalski, professor, McArdle Laboratory, University of Wisconsin–Madison
Sarah G. Thomason, professor of linguistics, University of Pittsburgh
Tim Trachet, journalist and science writer, honorary chairman of SKEPP, Belgium
David Willey, physics instructor, University of Pittsburgh

United States

ALABAMA. Alabama Skeptics, Alabama. Emory Kimbrough. Tel.: 205-759-2624. 3550 Watermelon Road, Apt. 28A, Northport, AL 35476 US.

ARIZONA. Tucson Skeptics Inc. Tucson, AZ. James McGaha. E-mail: JMCGAHA@PimaCC.Pima.EDU. 5100 N. Sabino Foothills Dr., Tucson, AZ 85715 US. **Phoenix Skeptics,** Phoenix, AZ. Michael Stackpole, P.O. Box 60333, Phoenix, AZ 85082 US.

CALIFORNIA. Sacramento Organization for Rational Thinking (SORT) Sacramento, CA. Ray Spangen-burg, co-founder. Tel.: 916-978-0321; e-mail: kitray2@comcast.net. PO Box 2215, Carmichael, CA 95609-2215 US. http://home.comcast.net/~kitray2/site/. **Bay Area Skeptics** (BAS) San Francisco—Bay Area. Tully McCarroll, Chair. Tel.: 415 927-1548; e-mail: tullyann@pacbell.net. PO Box 2443 Castro Valley, CA 94546-0443 US. www.BASkeptics.org. **Independent Investigations Group (IIG),** Center for Inquiry–*West*, 4773 Hollywood Blvd, Los Angeles, CA 90027 Tel.; 323-666-9797 ext. 159; Web site:www.iigwest.com. **Sacramento Skeptics Society,** Sacramento. Terry Sandbek, President. 4300 Auburn Blvd. Suite 206, Sacramento CA 95841. Tel.: 916 489-1774. E-mail: terry@sandbek.com. **San Diego Association for Rational Inquiry** (SDARI) President: Paul Wenger. Tel.: 858-292-5635. Program/general information 619-421-5844. Web site: www.sdari.org. Postal address: PO Box 623, La Jolla, CA 92038-0623.

COLORADO. The Denver Skeptics Meetup Group. Elaine Gilman, President. Skype address: elaine.gilman. 965 S. Miller Street, 302, Lakewood, CO 80226. Web site: http://skeptics.meetup.com/131/.

CONNECTICUT. New England Skeptical Society (NESS) New England. Steven Novella M.D., President. Tel.: 203-281-6277; e-mail: board@theness.com. 64 Cobblestone Dr., Hamden, CT 06518 US. www.theness.com.

D.C./MARYLAND. National Capital Area Skeptics NCAS, Maryland, D.C., Virginia. D.W. "Chip" Denman. Tel.: 301-587-3827. e-mail: ncas@ncas.org. PO Box 8428, Silver Spring, MD 20907-8428 US. http://www.ncas.org.

FLORIDA. Tampa Bay Skeptics (TBS) Tampa Bay, Florida. Gary Posner, Executive Director. Tel.: 813-849-7571; e-mail: tbs@cfiflorida.org; 5201 W. Kennedy Blvd., Suite 124, Tampa, FL 33609 US. www.tampabayskeptics.org. **The James Randi Educational Foundation.** James Randi, Director. Tel: (954)467-1112; e-mail jref@randi.org. 201 S.E. 12th St. (E. Davie Blvd.), Fort Lauderdale, FL 33316-1815. Web site: www.randi.org.

ILLINOIS. Rational Examination Association of Lincoln Land (REALL) Illinois. Bob Ladendorf, Chairman. Tel.: 217-546-3475; e-mail: chairman@reall.org. PO Box 20302, Springfield, IL 62708 US. www.reall.org.

KENTUCKY. Kentucky Assn. of Science Educators and Skeptics (KASES) Kentucky. 880 Albany Road, Lexington, KY 40502. Contact Fred Bach at e-mail: fredwbach@yahoo.com; Web site www.kases.org; or (859) 276-3343.

LOUISIANA. Baton Rouge Proponents of Rational Inquiry and Scientific Methods (BR-PRISM) Louisiana. Marge Schroth. Tel.: 225-766-4747. 425 Carriage Way, Baton Rouge, LA 70808 US.

MICHIGAN. Great Lakes Skeptics (GLS) SE Michigan. Lorna J. Simmons, Contact person. Tel.: 734-525-5731; e-mail: Skeptic31@aol.com. 31710 Cowan Road, Apt. 103, Westland, MI 48185-2366 US. **Tri-Cities Skeptics**, Michigan. Gary Barker. Tel.: 517-799-4502; e-mail: barkerg@svol.org. 3596 Butternut St., Saginaw, MI 48604 US.

MINNESOTA. St. Kloud Extraordinary Claim Psychic Teaching Investigating Community (SKEPTIC) St. Cloud, Minnesota. Jerry Mertens. Tel.: 320-255-2138; e-mail: gmertens@stcloudstate.edu. Jerry Mertens, Psychology Department, 720 4th Ave. S, St. Cloud State University, St. Cloud, MN 56301 US.

MISSOURI. Skeptical Society of St. Louis (SSSL) St. Louis, Missouri. Michael Blanford, President. E-mail: info@skeptical stl.org. 2729 Ann Ave., St. Louis, MO 63104 US. www.skepticalstl.org.

NEVADA. Skeptics of Las Vegas, (SOLV) PO Box 531323, Henderson, NV 89053-1323. E-mail: rbanderson@skepticslv.org. Web site: www.skepticslv.org./.

NEW MEXICO. New Mexicans for Science and Reason (NMSR) New Mexico. David E. Thomas, President. Tel.: 505-869-9250; e-mail: nmsrdave@swcp.com. PO Box 1017, Peralta, NM 87042 US. www.nmsr.org.

NEW YORK. New York Area Skeptics (NYASk) metropolitan NY area. Jeff Corey, President. 18 Woodland Street, Huntington, NY 11743, Tel: (631) 427-7262 e-mail: jcorey@liu.edu, Web site: www.nyask.com. **Inquiring Skeptics of Upper New York** (ISUNY) Upper New York. Michael Sofka, 8 Providence St., Albany, NY 12203 US. **Central New York Skeptics** (CNY Skeptics) Syracuse. Lisa Goodlin, President. Tel: (315) 446-3068; e-mail: info@cnyskeptics.org, Web site: cnyskeptics.org 201 Milnor Ave., Syracuse, NY 13224 US.

OHIO. Central Ohioans for Rational Inquiry (CORI) Central Ohio. Charlie Hazlett, President. Tel.: 614-878-2742; e-mail: charlie@hazlett.net. PO Box 282069, Columbus OH 43228 US. **South Shore Skeptics** (SSS) Cleveland and counties. Jim Kutz. Tel.: 440 942-5543; e-mail: jimkutz@earthlink.net. PO Box 5083, Cleveland, OH 44101 US. www.southshoreskeptics.org/. **Association for Rational Thought** (ART) Cincinnati. Roy Auerbach, president. Tel: 513-731-2774, e-mail: raa@cinci.rr.com. PO Box 12896, Cincinnati, OH 45212 US. www.cincinnati skeptics.org.

OREGON. Oregonians for Science and Reason (O4SR) Oregon. Jeanine DeNoma, president. Tel.: (541) 745-5026; e-mail: wilkinsa@peak.org; 39105 Military Rd., Monmouth, OR 97361 US. Web site: www.04SR.org.

PENNSYLVANIA. Philadelphia Association for Critical Thinking (PhACT), much of Pennsylvania. Eric Krieg, President. Tel.: 215-885-2089; e-mail: erickrieg@verizon.net. By mail C/O Ray Haupt 639 W. Ellet St., Philadelphia PA 19119.

TENNESSEE. Rationalists of East Tennessee, East Tennessee. Carl Ledenbecker. Tel.: 865-982-8687; e-mail: Aletall@aol.com. 2123 Stonybrook Rd., Louisville, TN 37777 US.

TEXAS. North Texas Skeptics NTS Dallas/Ft Worth area, John Blanton, Secretary. Tel.: 972-306-3187; e-mail: skeptic@ntskeptics.org. PO Box 111794, Carrollton, TX 75011-1794 US. www.ntskeptics.org.

VIRGINIA. Science & Reason, Hampton Rds., Virginia. Lawrence Weinstein, Old Dominion Univ.-Physics Dept., Norfolk, VA 23529 US.

WASHINGTON. Society for Sensible Explanations, Western Washington. Tad Cook, Secretary. E-mail: K7RA@arrl.net. PO Box 45792, Seattle, WA 98145-0792 US. http://seattleskeptics.org.

PUERTO RICO. Sociedad De Escépticos de Puerto Rico, Luis R. Ramos, President. 2505 Parque Terra Linda, Trujillo Alto, Puerto Rico 00976. Tel: 787-396-2395; e-mail: Lramos@escepticospr.com; Web site www.escepticor.com.

The organizations listed above have aims similar to those of the Committee for Skeptical Inquiry but are independent and autonomous. Representatives of these organizations cannot speak on behalf of CSI. Please send updates to Barry Karr, P.O. Box 703 Amherst NY 14226-0703.

CENTERS FOR INQUIRY

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3965 Rensch Road, Amherst, NY 14228
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Tel.: (512) 919-4115

CHICAGO
PO Box 7951, Chicago, IL 60680-7951
Tel.: (312) 226-0420

INDIANAPOLIS
350 Canal Walk, Suite A, Indianapolis, IN 46202
Tel.: (317) 423-0710

MICHIGAN
3777 49th Street SE, Grand Rapids, MI 49512
Tel.: (616) 698-2342

NEW YORK CITY
PO Box 26241, Brooklyn, NY 11202
Tel.: (347) 987-3739

SAN FRANCISCO
E-mail: sf@centerforinquiry.net

TAMPA
5201 West Kennedy Blvd., Suite 124, Tampa, FL 33609
Tel.: (813) 849-7571

WASHINGTON, DC
621 Pennsylvania Ave. SE, Washington, DC 20003
Tel.: (202) 546-2330

WEST
4773 Hollywood Blvd., Hollywood, CA. 90027
Tel.: (323) 666-9797

ARGENTINA
Av. Santa Fe 1145 - 2do piso, (C1059ABF) Buenos Aires, Argentina
Tel.: +54-11-4811-1858

CHINA
China Research Institute for Science Population, NO. 86, Xueyuan Nanlu Haidian Dist., Beijing, 100081 China
Tel.: +86-10-62170515

EGYPT
44 Gol Gamal St., Agouza, Giza, Egypt

FRANCE
Dr. Henri Broch, Universite of Nice, Faculte des Sciences, Parc Valrose, 06108, Nice cedex 2, France
Tel.: +33-492-07-63-12

GERMANY
Kirchgasse 4, 64380 Rossdorf, Germany
Tel.: +49-6154-695023

INDIA
A 60 Journalist colony, JubileeHills, Hyderabad-500033, India
Tel.: +91-40-23540676

LONDON
Conway Hall, 25 Red Lion Square, London WC1R 4RL, England
E-mail: slalvani@centerforinquiry.net

NEPAL
Humanist Association of Nepal, PO Box 5284, Kathmandu Nepal
Tel.: +977-1-4413-345

NEW ZEALAND
E-mail: bcooke@centerforinquiry.net

NIGERIA
PO Box 25269, Mapo, Ibadan, Oyo State, Nigeria
Tel.: +234-2-2313699

ONTARIO
216 Beverley Street, Toronto, Ontario, M5T 1Z3, Canada
Tel.: (416) 971-5676

PERU
D. Casanova 430, Lima 14 Peru
E-mail: cipsiperu@yahoo.com

POLAND
Lokal Biurowy No.8, 8 Sapiezynska Sr., 00-215, Warsaw, Poland

ROMANIA
Fundatia Centrul pentru Constiinta Critica
Tel.: (40)-(0)744-67-67-94
E-mail: CenterforInquiry.Romania@gmail.com

RUSSIA
Dr. Valerii A. Kuvakin, 119899 Russia, Moscow, Vorobevy Gory, Moscow State University, Philosophy Department

SENEGAL
PO Box 15376, Dakar – Fann, Senegal
Tel.: +221-501-13-00

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